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The sixth break in a line of 2,000 ft. of 16-in. cast iron submerged supply main, forming a part of the water-works of Perth Amboy, N. J., occurred a few days ago. A representative of this Journal obtained the following facts at Perth Amboy from Mr. Adam Eckert, Superintendent of the city water-works: The main was laid and put in use in 1893, and gave no trouble that year. Only one break took place in 1894, but thus far this year there have been five. All breaks have been at ordinary leaded joints, ball and socket joints having been put in only for every third length of pipe. Five of the six leaks have been on a stretch of the pipe about 300 ft. long, and all the trouble has been in shallow water and has been caused by ships' bottoms. One bell was broken, and at the present leak the joint is 4 ins. out of line in a distance of 3 ft. To repair these leaks, hub-shaped sleeves to fit over the bells are used. These are, of course, made in two sections, and are provided with flanges and fastened together with 1-in. bolts, sheet lead being placed between the flanges. At each end of the sleeves three grooves, until recently, and now only two, are cast on the inner circumference. Before placing the sleeves a lead fillet is cast into the inside groove to make the sleeve fit as snugly as possible when applied. The sleeve is then calked cold at either end, using lead strips. On the last sleeves constructed lugs have been cast at each end and wrought bands fitting tightly against the lead bolted on. Each sleeve, leaded, weighs about 900 lbs. The sleeves have been made by Schentz & Eckert, of Perth Amboy. The city council will probably issue bonds under a new water act for a duplicate 16-in. main, with a ball and socket joint for each length of pipe. It is hoped that the new main will be put down this summer, but no definite action to that end had been taken up to June 14.

The members of the new East River Bridge Commission appointed by Mayor Strong, of New York, and Mayor Schieren, of Brooklyn, are as follows: For New York, Mr. Salem H. Wales, formerly Dock Commissioner and President of the Board of Park Commissioners; Mr. F. B. Thurber, a business man, and Mr. Richard Deeves, a prominent builder. The Brooklyn members are Mr. Andrew D. Baird, once candidate for Mayor of Brooklyn; Mr. Henry Batterman, a large retail dry goods merchant, and Mr. James A. Sperry, editor of the Brooklyn "Times. These commissioners will have charge of the business of constructing the proposed new bridge across the East River, and remain in office until the structure is completed, or their successors named. None of them are civil engineers.

New plate girders are being placed on parts of the Ninth Ave. line of the New York Elevated R. R. The old plate girders rested on saddles on the columns, and had no web stiffeners, while the new girders are the full depth from top of column to bottom of tie, and have the usual stiffeners. During the work one track is taken up at a time, the trains being diverted onto the third or middle track. At stations short platforms are built out to the middle track to afford communication to the car platforms.

The concrete foundations for St. John's Cathedral, at 112th St. and Amsterdam Ave., New York, are well advanced, and the laying of the granite foundation stones has been commenced. The site is on the summit of a rocky ridge, and the rock is in general hard and of good quality, with some pockets of soft rock, which are thoroughly cleaned out. The concrete is measured and mixed by machinery, the dry cement and sand being dumped by link-belt bucket conveyors into one compartment, where they are mixed by a revolving screw and carried along to another compartment, where the stone is added by another conveyor, and where also the water is added. The mixture is comparatively dry as compared with ordinary concrete work, extensive tests having been made as to the efficiency of different mixtures. The concrete is composed of 1 part cement, 2 parts sand and 3 parts stone. The cement is "sand cement," and Aalborg and Germania Portland cement. The stone is round, smooth pebbles, which is considered superior to broken stone. The work is being done by Sooysmith & Co., of New York.

The conditions under which the three new torpedo-boats are to be bid for at Washington are somewhat exacting, and unlike the former call for proposals. Each boat is to cost not more than $175,000, without ordnance outfit; the contracts must be awarded to firms on the Gulf of Mexico, Mississippi River and Pacific Coast respectively; the speed required is 26 knots, but no premium will be paid for excess speed, and a forfeit of $10,000 for every knot less than 26 will be demanded, with possible rejection of the vessel if the speed is below 25 knots. The boats must be built within 15 months; and if no satisfactory bids come from the sections named, the Secretary may call for general bids. The dimensions of the boats are: Length on load water-line, 170 ft; extreme beam on same, 17 ft.; mean normal draft, 5 ft. 6 ins.; normal displacement, 180 tons; I. HP., 3,200. The armament will consist of three torpedo-tubes and mounts, four 1-pdr. rapid-fire guns, four automobile torpedoes, 600 rounds of 1-pdr. ammunition. The torpedo discharges will be on the main deck; two forward in echelon; one aft on the center line with an arc of fire of 280°. Two conning towers will be placed 35 ft. from either end, with steering gear connected and one 1-pdr. gun mounted on the forward tower. Steam, at 250 lbs. pressure, will be supplied by three water-tube boilers. The normal coal supply will be 12 tons, with bunker capacity for 60 tons.

The most fatal railway accident of the week was that of June 11 on the C., C., C. & St. L. R. R., near Houston, O. A break in a train caused a rear collision at the foot of a steep grade, and 5 cars were wrecked, and 3 tramps in them were instantly killed. A rumor has it that 12 tramps were killed on the same day by a wreck on the Philadelphia & Erie R. R., near Kane, Pa. The trucks of a freight car left the rails at a frog, and 14 cars were wrecked as a consequence. Two express trains on the Charleston & Savannah R. R. collided on June 16, near Hardeville, S. C. The engineer of one train had his leg crushed and two tramps were killed. On June 16 the New York Sunday newspaper train was completely wrecked at New Haven, Conn. The train was entering the sharp curves of a cross-over at a speed of 55 miles, and broke in two.

Kansas City has voted almost unanimously in favor of purchasing the plant which supplies the city with water, and which is owned by a private company, the vote standing 11,587 for and only 481 against. The question of municipal ownership of the works has been before the people for a number of years, and their verdict has always been in favor of such a course. The company has fought the proposition in and out of the courts, but the latter finally rendered a peremptory decision that the city must buy, under the contract between it and the company. The recent vote appears to have been on the question of providing money to carry out the order of the court, with the alternative that if bonds were not issued the money, or part of it, must be raised by taxation.

The bonds, $3,000,000 in amount, bearing 4½ interest, were sold provisionally some time ago, but have not been issued. An attempt is now being made to secure an injunction prohibiting their issuance on the grounds that they will carry the city beyond its limit of bonded indebtedness.

The U. S. protected cruiser "Columbia," on her way to Kiel, made the trans-Atlantic trip with an average speed of 16.4 knots, using only six of her boilers. On entering the British Channel this speed was increased to 20 knots. Under forced draft and with eight boilers, she made 22 knots on her trial trip.

About 1,000 acres of new parks are to be provided for Kings County, N. Y., which will soon be identical in extent with the city of Brooklyn. The present park area of Brooklyn is 754 acres, of which Prospect Park comprises 526 acres. The largest of the new parks will be 500 acres, along the ridge between Cypress Hills Cemetery and Richmond Hill, in the eastern district of Brooklyn. Other parks will be located near Fort Hamilton, and one each on the beach at Bensonhurst and on Canarsie Bay. In addition, six small parks will be provided. Messrs. Olmstead, Olmstead & Eliot are consulting landscape architects to the Brooklyn Park Department, and have advised Park Commissioner Squier in selecting these park sites.

A quadruple-expansion engine using steam at pressures of 500 to 620 lbs. has been built and tested at Cornell University by Messrs. Thos. Hall and C. H. Treat, two students graduating this year, and is said to have developed a horse-power-hour on less than 10 lbs. of steam. Besides the use of such high pressures, the engine has the very novel feature of using the waste heat in the flue gases to reheat the steam between the cylinders. In this way, it is stated, that the gases leaving the reheater between the second intermediate and low pressure cylinders have been cooled down to less than 212°. The engine is furnished with steam by a coil boiler built to carry 1,000 lbs. pressure. It has been tested with a hydraulic pressure of 1,300 lbs. The engine is balanced by setting the cranks alternately 180° apart, and this balance is so effective that the engine has been run at 500 revolutions per minute, standing on a block foundation and not bolted down in any way. The question of lubrication is one of greatest importance in an engine using very high pressure steam. In this case, however, ordinary heavy cylinder oil was used, fed by a Swift lubricator on the steam pipe, and no trouble has been experienced. The stuffing boxes are of extra depth, and are packed with asbestos wicking and graphite. A description of the engine is given in our contemporary "Power" for June.

The English cruiser "Terrible," launched on May 27 from the yards of J. & G. Thompson, at Clydebank, is the largest, most powerful and is expected to be the fastest war-ship of her class afloat. The first frame was put up on April 4, 1894, so that she was made ready for launching in 14 months. The general dimensions of the "Terrible" are here compared with similar cruisers of other nations:

Dimensions, etc.	Terrible. Twin screw.	D'Entre Casteaux. Twin screw.	Dupuy de Lome. Triple screw.	Columbia. Triple screw.	Kaiserin Augusta. Triple screw.
Displacement, tons..	14,200	8,114	6,257	7,475	6,052
Length, ft.....	500	384	374	412	393
Beam, ft.....	71½	58½	51½	58	49½
Ratio of len. to beam.	6.99	6.56	7.26	7.08	7.97
Draft, ft.	27	23½	23½	22½	23
Horse-power	25,000	14,000	14,000	21,500	12,000
Coal cap., tons.....	1,500 or 3,000	1,000	900	2,400	.....
Coal endurance at 10 knots	.....	.....	4,000	13,000	10,000
Speed, knots	22	19	20	22.8	20

It will be seen from the above that the new cruiser is most nearly approached in power, etc., by the United States cruiser "Columbia," though the speed of the "Terrible" is yet to be tested. The main battery of the Englishman will far exceed that of the American boat, however. The "Terrible" will have two 9-in. and twelve 6-in. guns, as compared with one 8-in., two 6-in. and eight 4-in. guns for the "Columbia." The deck protection of the former will also be 4 ins., with 3-in. armor over the end, as compared with 4 ins. on the slope and 2½ ins. on the flat, for the latter ship.

The amount of water used and wasted by a village watering trough has just been measured at Port Chester, N. Y. The trough is used by about 300 horses from 6 a. m. to 9 p. m., and but little used during the balance of the 24 hours, although the water flows at the same rate at night as during the day. The trough is supplied from the works of the Port Chester Water Co. This company has a contract to furnish water for fire protection through 64 hydrants for a total of $1,500 a year, with $25 each for additional hydrants. Besides this, water must be furnished free to the amount of 3,500,000 gallons a year, for the municipal building, a fire engine house, for sewer flushing and one watering trough. The application of a meter to the water-trough showed that water was passing through the supply pipe at the rate of 1,900,000 gallons a year, which would leave only 1,600,000 gallons for the other purposes specified. The night flow is practically wasted. We are indebted to Mr. R. C. Bacot, Jr., Inspector of Meters and Services for the above company, for this information. Mr. Bacot says that "the cure is to use a ball valve and tank."

Bids for the construction of the Jerome Park reservoir will be received by the New York Aqueduct Commissioners until July 10. The reservoir is to be located in the district annexed to New York by action of the recently adjourned legislature, and will be a large one.

Electric launches are to be operated on the lakes of the Cotton States & International Exposition at Atlanta, Ga., and a concession for running these boats has been awarded to Gen. C. H. Barney, of New York.

CHICAGO MAIN DRAINAGE CHANNEL.

V.

Sections H and G.

These two sections are much like the preceding sections in their physical characteristics, the material being a hard brick clay, somewhat sandy in places, covered with about 5 or 6 ft. of prairie loam. They were put under contract to Gahan & Byrne, of Chicago, Ill., Dec. 23, 1893, the prices for excavation being 29 cts. per cu. yd. for Section H, and 28 cts. per cu. yd. for Section G. According to the latest estimates the amounts of material to be excavated are 1,077,032 cu. yds. and 1,363,475 cu. yds., respectively, for the two sections. Like the preceding sections the channel is 110 ft. wide on the bottom, with side slopes of 2 to 1, and the spoil banks are parallel with the channel and 80 ft. distant from its edge.

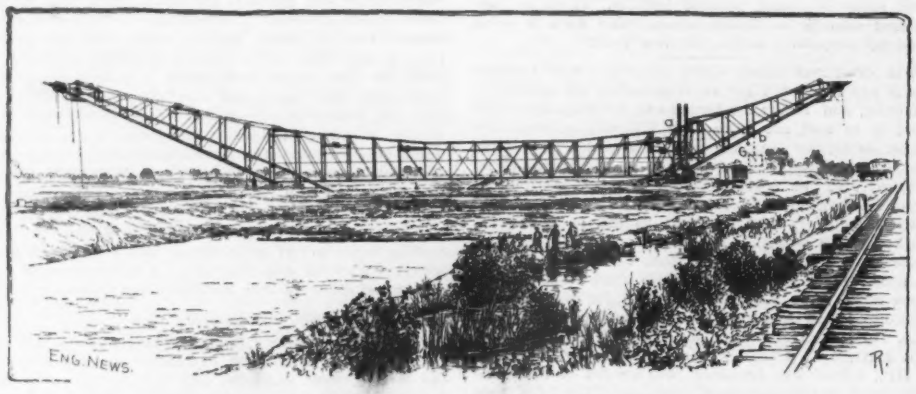


FIG. 15 VIEW OF DOUBLE CANTILEVER CONVEYOR ON SECTION H.

Early in the spring of 1894 the contractors began to install their plant. Teams and dump cars loaded by steam shovel were first put at work on the east end of Section G, and a little later a belt conveyor was put in operation on the west end of the same section. On Section H a monster apparatus, designed by Hoover & Mason, of Kansas City, Mo., was completed late in the season of 1894, and early in 1895 two incline conveyors, much like those used on Sections M and L, were installed, one on the east end of Section H, and the other about the middle of Section G.

More or less excavation has been done by each of these plants, but up to this time the bulk of the material has been taken out by the belt conveyor such notes of their capacity will be given as are available.

The apparatus designed by Hoover & Mason may be called a double cantilever conveyor for want of a better name. Its general design is pretty clearly shown by Fig. 15, which is sketched from a photograph. It consists of a bridge 320 ft. long spanning the channel, with a cantilever arm at each end, extending over the spoil bank. The south cantilever arm is 148 ft. long, and the north 172 ft. long, making the total length of the structure, from tip to tip of the cantilevers, 640 ft. The whole structure is supported on cars placed at the ends of the main span. These cars run on tracks laid along the berms of the channel.

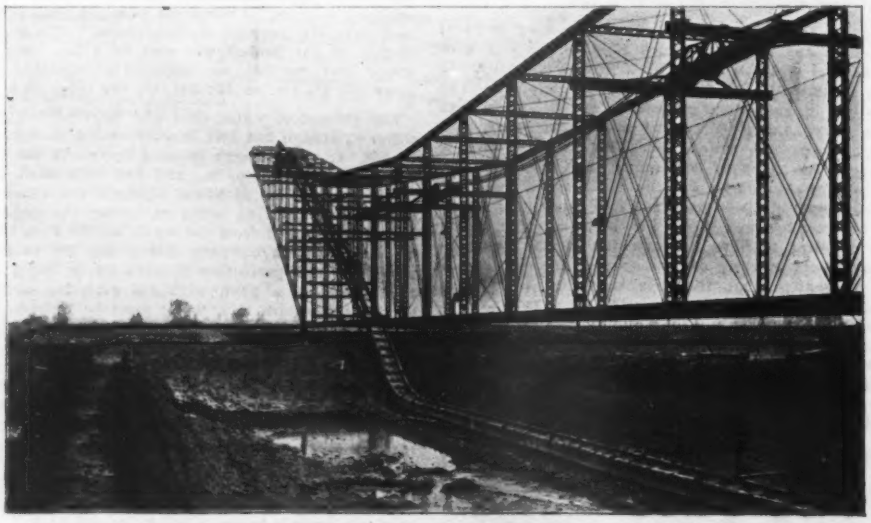


FIG 16. DETAIL VIEW OF DOUBLE CANTILEVER CONVEYOR SHOWING SYSTEM OF EXCAVATION.

and dump cars and scrapers. The reason of this is that the Hoover & Mason conveyor has been partially wrecked twice by unfortunate accidents, and the incline conveyors have been at work for a short time only. The several machines and their methods of operation will be described here, and

At the extremities of the cantilevers are large drums over which a steel belt, composed of a series of steel pans linked together, mounted on trunnions and traveling on a track between the trusses, is caused to pass. This belt is endless, and is propelled by suitable machinery placed on the car running along the south bank of the channel. The sag of the belt goes to the bottom of the channel, and the material is loaded into it by means of a gang of plows operated by cables and winding engines. Fig. 16 shows this arrangement quite clearly, although the pit was not sunk the full depth of the channel when the view was taken. The plows are hauled transversely across the channel, shaving down the bank against which the belt lies. The diagram, Fig. 17, indicates the process quite clearly. Of course, as the belt or pans reach the extremity of the cantilever and pass over the drums, the earth with which they are filled falls out; the operation of the belt being, in fact, exactly like that of a bucket conveyor for handling grain or other material.

Shortly after the completion of the conveyor in November, 1894, one of the temporary timber supports for the belt track, which was held up by a jack, failed, owing to the slipping of the jack, and the belt, loaded with dirt, sagged down onto the bottom laterals. The shock, coupled with the pull of the machinery on the deranged belt, caused the north cantilever arm to buckle and fall in a complete wreck. Work was begun at once rebuilding the ironwork, and as this was about finished, another accident wrecked the structure. During a severe gale on Jan. 21, 1895, the conveyor, which had not been anchored securely, was blown along the tracks until the leading trucks fell off the ends of the rails, overturning the whole structure. Both cantilevers were wrecked, but the main truss was but little injured. Again the work of rebuilding was begun, but this time it was decided to leave off the south or shorter cantilever arm. Accordingly a tie was run from a to b (Fig. 15), and a heavy counterweight, G, suspended at b, the remainder of the ironwork being removed. With the exception of the modifications required by this change, the machinery, pans, drums, etc., are exactly as they were in the original structure. As the conveyor cost $32,000 originally, it will be readily understood that considerable confidence and courage were required on the part of the contractors to rebuild it twice, although, of course, the cost of rebuilding was far less than the first cost of the work. On the whole, the conveyor is probably the most elaborate and costly device on the entire channel, besides being the widest departure from ordinary methods of excavation.

Owing to the accidents just described, little excavation has been done by the conveyor. Just before the first accident, and before the plows had been got into good working order, 940 cu. yds. per ten-hour day were being taken out. The designers express their confidence that over three times this amount can be handled with everything

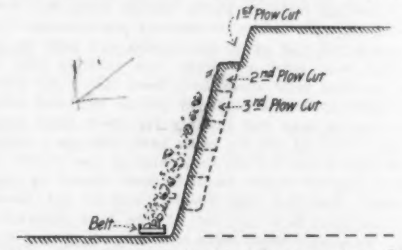


Fig. 17. Diagram Longitudinal Section along Channel Showing Manner of Pans.

in good working order. In fact, from 2,500 cu. yds. to 3,000 cu. yds. per day must be handled in order to make the device an economical success in comparison with other methods of excavation used on the channel. In a future issue we hope to give figures showing exactly what the machine can do.

The belt conveyor referred to above has been worked on Section G, taking off the top cut of about 12 ft. This apparatus was designed by Mr. Lindon W. Bates, of Chicago, Ill., and is simply an endless rubber belt, 22 ins. wide, running transversely across the channel and over the spoil bank. Along the bottom of the channel and up the slope the belt is guided by a wooden frame with suitable rollers, and over the spoil bank it runs on a steel truss as is clearly shown by Fig. 18. The belt is operated by an engine placed on a car traveling along the berm about 40 ft. from the edge of the channel. A steam shovel loading into a granulator supplies the dirt to the belt, and a metal scraper placed on the truss sweeps it off onto the spoil bank. The granulator is similar to those used in brick yards, and, as the name signifies, is used to pulverize the earth coming from the steam shovel, so that it can be easily conveyed by the belt. It is mounted on a car which travels transversely across the canal as the excavation advances. When the shovel has completed a cut clear across the channel, the truss, which is mounted on cars, the belt frame, granulator and steam shovel tracks, etc., are moved toward the face and a new cut made. In this manner the whole apparatus travels along the channel, taking out a cut about 12 ft. deep the full width.

In the illustration, Fig. 18, the belt is shown running across the bottom of the channel, up the slope and over the truss, while in the left foreground is the steam shovel with the granulator just

beyond. Detail drawings of the whole apparatus were published in Engineering News, Sept. 20, 1894, which may be studied by those desiring more exact information.

The capacity of the belt conveyor to excavate the hard clay in which it is working is from 300 cu. yds. to 800 cu. yds. per ten-hour day, depending upon the weather, breakdowns of machinery, etc. The exact record of work taken from the reports

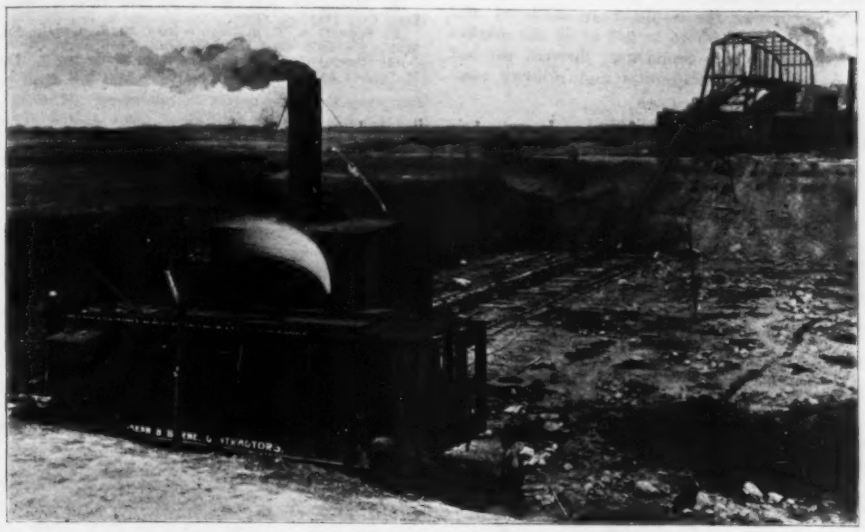


FIG. 18. VIEW SHOWING BATES' BELT CONVEYOR IN OPERATION ON SECTION G.

of the Superintendent of Construction for four months of 1894 is as follows:

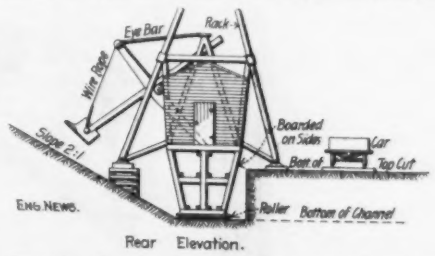
Month.	Ten-hour shift.	Cu.yds. per shift.
September, 1894	..	419
October, 1894	23	777½
November, 1894	..	651
December, 1894	20	313

These figures, it must be understood, represent pit measurements, and are per day worked, and not per working day. For example, in the month of September the conveyor handled 419 cu. yds per day worked, and only 318 cu. yds. per working day. The steam shovel (a Victor, Class No. 1) is limited by the capacity of the belt to handle the dirt here, instead of being the limiting factor itself, as is the case with the bridge conveyors on Sections K and I and the inclines on Sections M and L. Rainy weather and snow are especially bad for the belt, the moisture causing it to slip and clog.

The steam shovel and dump car plant working on the east end of Section G call for little mention. Peteler cars of 1 cu. yd. capacity, hauled by teams are used. During the months of September, November and December, 1894, the amounts of materials excavated per shovel ten-hour shift were 662 cu. yds., 920 cu. yds. and 841½ cu. yds., respectively. As with the belt conveyor, the amount of material handled per day worked was greater than the amount handled per working day. In September the respective figures were 662 cu. yds. and 556 cu. yds. The steam shovel and tram car plant has worked on the upper lift only. To take out the lower lift one of the incline conveyors is used.

Before describing this incline conveyor, brief mention may be made of a trenching machine used on Section G. In making a transverse cut across the channel with a steam shovel, there always remains a triangular mass of earth at each end to cut out by hand. This is necessary in order to preserve the slope. The trenching machine was designed to take out this slope cut by digging a trench along the channel, as shown by Fig. 19, which is a part transverse section of the channel showing a rear elevation of the trenching machine. As will be seen, the trenching machine is simply a modification of a steam shovel, so arranged that the slope can be cut out by the dipper. The operation of the machine is evident from the sketch.

The incline conveyors, two of which are used, were designed by Mr. J. W. Page, the engineer for the contractors. Fig. 20 shows the construction of one of these inclines, and Fig. 21 is a view of the same device reproduced from a photograph. As will be seen, the machine has tipples at its upper end, which revolve on a horizontal axis and dump the cars just as do the tipples used on Sections M and L. The location and operation of the boiler room, engine house and hoisting ropes are indicated in Fig. 20 (p. 396). In the pit the method of operation is similar to that on Sections K and I. Instead of taking a longitudinal cut along the channel, as is done on Sections M and L, the tracks run down the slope and across the bottom of the channel, and the steam shovel makes a transverse cut, as is done on Sections K and I. In brief, the



Rear Elevation.

Fig. 19. Sketch of Trenching Machine Used on Section G.

conveyor system of Sections M and L is combined with the system of excavation used on Sections K and I.

The foregoing description indicates pretty clearly the methods of work on Sections G and H. To sum up briefly, however, the top soil, to a depth of from 4 ft. to 6 ft. over both sections, has been removed by teams, scrapers, etc.; on Section G the top cut is being made by the dump car and steam shovel plant and by the belt conveyor, and the bottom cut is being made by one of the incline conveyors; and on Section H the other incline conveyor and the double cantilever conveyor are used.

We are indebted to the engineers of the Sanitary District of Chicago and to Mr. J. W. Page, engineer for Gahan & Byrne, the contractors, for much aid in securing the matter from which this article and the accompanying illustrations have been prepared.

BOILERS OF THE CITY ELECTRIC LIGHTING PLANT OF DETROIT, MICH.

(With Inset.)

The largest municipal electric lighting plant in this country is that at Detroit, Mich., supplying at the commencement 1,500 arc lights of 46 volts and 9.6 amperes each. The complete specifications for this plant were published in our issue of March 1, 1894, and called for seven water-tube boilers, each with a minimum heating surface of 3,000 sq. ft., and with a guaranteed evaporation per hour of not less than 9,000 lbs. of water at 100° F. into steam at 165 lbs. pressure, this being the working pressure, while the boilers were to be tight under a cold water pressure of 205 lbs. per sq. in. The contract for the boilers was let to Charles A. Strelinger, of Detroit, Mich., for seven Peck double-deck boilers, with Hawley down-draft furnaces, the contract price being $31,500, or $14.77 per nominal horse power. The boilers were built by C. C. Peck, of Rochester, N. Y., to whom we are indebted for the blueprints from which the drawings on our inset sheet were prepared.

The boiler room is a brick structure 150 × 48 ft., with iron truss roof, the building being parallel with and connected with an engine and dynamo room, 150 × 50 ft., while the steel smokestack, 9 ft. diameter and 150 ft. high, is between the two buildings. Coal bins extend the whole length of the outer side of the boiler room. There are six boilers arranged in pairs, and the seventh is set separately. The walls of the furnaces and boiler setting are of red brick, 17½ ins. thick, with a 9-in. firebrick lining, and the furnaces of the double sets of boilers are separated by an 18-in. firebrick wall extending back to the 9-in. bridge wall, or fire arch. This arch is semi-circular, 4 ft. diameter, and is a special feature of the boiler setting, protecting the shell from the direct action of the fire, so that there is no liability of failure in case pockets should form from dirt or scale collecting on the heating surface, which often happens in ordinary externally-fired boilers. As shown by the arrows on the longitudinal section, the air passes down through the main water grate and up through the ashpit, then under the brick arch to the rear of the boiler, returning to the front through the fire tubes, then back again through a flue embracing the lower part of the steam drum, and down to a smoke flue 54 ins. square at the level of the boiler room floor. The main shell of the boiler is suspended by slings from two sets of 15-in. I-beams, 80 lbs. per yd., resting on the side walls. Each sling has the 3-in. top end threaded and fitted with a nut, while the lower end has a ¾-in. plate riveted to the boiler shell.

FIG. 21. VIEW OF STEEL INCLINE AND TIPPLE FOR INCLINE CONVEYOR.

The main shell of the boiler is 19 ft. long, and 7 ft. 5 ins. outside diameter, built up of ¾-in. plates, with a single horizontal seam, butt jointed, with inside and outside ½-in. cover strips. This shell or barrel contains 146 tubes, 4 ins. diameter and 19 ft. long. The tubes are not staggered, but are in vertical and horizontal rows, with a pitch of 5¼ ins. for the former and 5½ ins. for the latter. Above this is another drum, 5 ft. 1⅛ in. outside diameter and 18 ft. 9½ ins. long, with dished heads. This is of 9-16-in. plates, with 9-16-in. heads, and ⅜-in. joint cover strips. On the top of this drum are a 7-in. steam connection, 2-in. feed connection and a connection for two 4-in. pop valves. These drums are connected near each end by a vertical neck of ⅝-in. steel, 27 ins. outside diameter and 16 ins. high at the middle. The shell openings connecting with this neck are strengthened by inside rings 10 ins. wide and ½ in. thick.

The water level is at the middle of the upper drum, and circulation is effected by means of a curved circulating plate under the front neck. The cooler water in the upper drum flows down through this neck, and then between the shell and the circulating plate to the bottom of the boiler, while the hotter water (being prevented by the plate from rising in the front neck) rises and passes up through the rear neck, as shown by the dotted arrows. From the bottom of the front end of the shell is a 5-in. connection leading the cooler water to the front drum of the water grate, the water flowing up through the inclined tubular grate bars, and through a 6-in. pipe back to the top drum. The boiler fronts are of iron, fitted with hinged doors. The total length over boiler front and back wall is 24 ft. 3 ins., and the total height to top of the upper drum is 18 ft. 9 ins. The Hawley down-draft furnace has been described in our issues of Jan. 30, 1892, and March 23 and Sept. 7, 1889, and is now in quite extensive use.

THE MASTER CAR BUILDERS' LABORATORY TESTS OF BRAKESHOES.

In 1893 the Master Car Builders' Association appointed a committee to conduct a series of laboratory tests on different kinds of brakeshoes, for the purpose of determining the comparative efficiency and economy of the brakeshoes in use or on the market in this country. This committee, through the aid of a number of manufacturers and railway companies, had an elaborate testing machine constructed in 1893-4 and began tests in the spring of 1895. This testing machine was fully described in the issue of Engineering News of June 28, 1894. The following extract from the report will recall its main features:

> A mass of metal in the form of a flywheel mounted on a shaft, having a weight the equivalent of 11,995 lbs. moving in a straight line, and capable of being moved by a stationary engine at any desired speed, was provided to represent the maximum weight that is carried on one journal of either a freight or passenger car. A chilled cast iron or steel tired wheel mounted on one end of the flywheel shaft served to represent a car wheel in actual service. The different brakeshoes to be tested were forced against this wheel with proper pressures by means of weights and levers. A trip was provided whereby the application of the brakeshoe might be made to the wheel instantaneously. After the fly and car wheel had been brought up to the required speed, the engine was shut off and disconnected by means of a clutch, the brakeshoe applied to the car wheel, and the moving mass brought to rest through the friction developed, which was recorded by means of the apparatus provided.

The results of the tests conducted with this machine were given in a report of the committee having the tests in charge, at the convention of the Master Car Builders' Association, held at Alexandria Bay, N. Y., last week. The main features of the results are given in the following abstract.

It was decided to test 14 shoes of the following materials and makes:

(A) Soft cast iron, made by the Pennsylvania R. R. Co., F. D. Casanave, General Supt. M. P., Altoona, Pa.
(B) Hard cast iron, made by the Ramapo Wheel & Foundry Co., Ramapo, N. Y.
(C) Soft open hearth steel, made by the Solid Steel Co., Alliance, Ohio.
(D) Hard open hearth steel, made by the Solid Steel Co., Alliance, Ohio.
(E) Malleable Iron, made by the Dayton Malleable Iron Co., Dayton, Ohio.
(F) Special S. T. malleable iron, made by the Dayton Malleable Iron Co., Dayton, Ohio.
(G) Special C. W. malleable iron, made by the Dayton Malleable Iron Co., Dayton, Ohio.

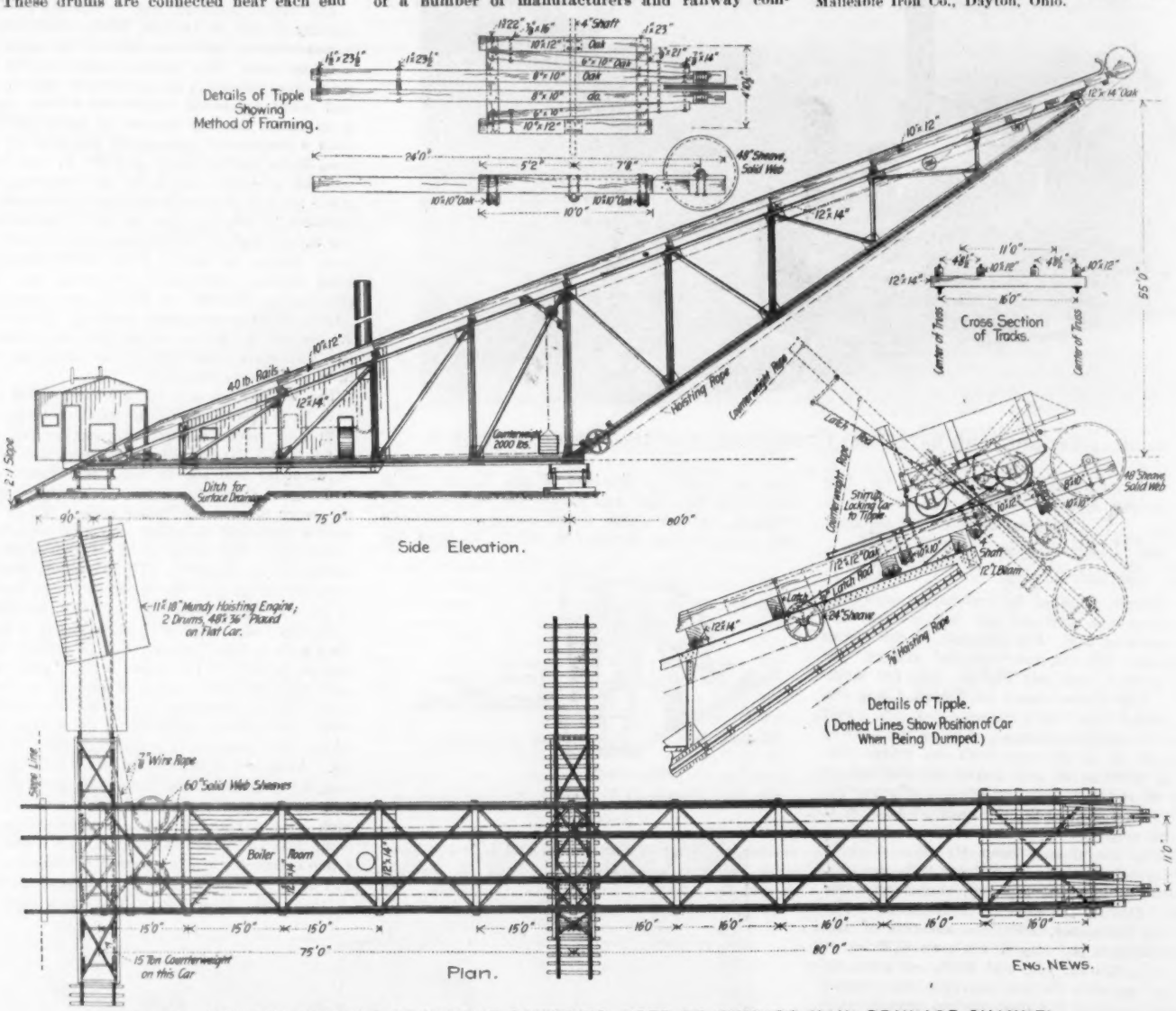


FIG. 20. GENERAL DETAILS OF INCLINE CONVEYOR, USED ON CHICAGO MAIN DRAINAGE CHANNEL.

(H) The Congdon Shoe, made by the Sargent Co., 59th and Wallace Sts., Chicago, Ill.
(I) The Meehan Shoe, made by the Sargent Co., 59th and Wallace Sts., Chicago, Ill.
(J) The Lappin Shoe, made by the Lappin Brake Shoe Co., No. 18 Broadway, New York city.
(K) The Safety Shoe, made by the Safety Brakeshoe Co., 620 Atlantic Ave., Boston, Mass.
(L) Soft Steel (pressed), made by the Schoen Manufacturing Co., Pittsburg, Pa.
(M) Wrought iron (pressed), made by the Schoen Manufacturing Co., Pittsburg, Pa.
(N) The Sargent Special Shoe, made by the Sargent Co., 59th and Wallace Sts., Chicago, Ill.

The tests to which each of these makes of brakeshoes was submitted were: (1) Freight service, with chilled cast iron wheels; brakeshoe pressure, 2,793 lbs., corresponding approximately to 70% of ⅛ of the light weight of the heaviest 60,000-lb. car, and speed 40 miles per hour; (2) passenger test with chilled cast iron wheel; brakeshoe pressure, 10,713 lbs., corresponding approximately to 90% of the weight of one journal of any one passenger, sleeping or dining car ordinarily hauled, and speed 60 miles per hour; (3) passenger service, with steel-tired wheel and same brakeshoe pressure and speed as in Test 2.

These brake pressures were selected as corresponding to those generally used at the present time. The brakeshoes were all turned and ground to the wheel, in order to insure a good bearing, and five tests of each shoe were made under each of the conditions just stated. The results of the tests were shown by a long tabulated statement, which is not given here, and by the accompanying diagrams. The report continues:

Your committee desires to point out the fact that while any brakeshoe may give the least mean coefficient of friction, it does not necessarily follow that it would be a desirable shoe to use in service. The results given in the tabulated statement show each test in detail, but in order to furnish an easy comparison, we present a representative diagram for each shoe tested. These diagrams have been made by reducing the actual representative diagram selected to a length of 4 ins., so that it is a somewhat conventionalized representation of the real diagram and serves to show only the relative friction of different shoes by the height of the diagram line from the base line, and does not show the variation in the length of the stop, resulting from greater or less friction, which the original diagram shows.

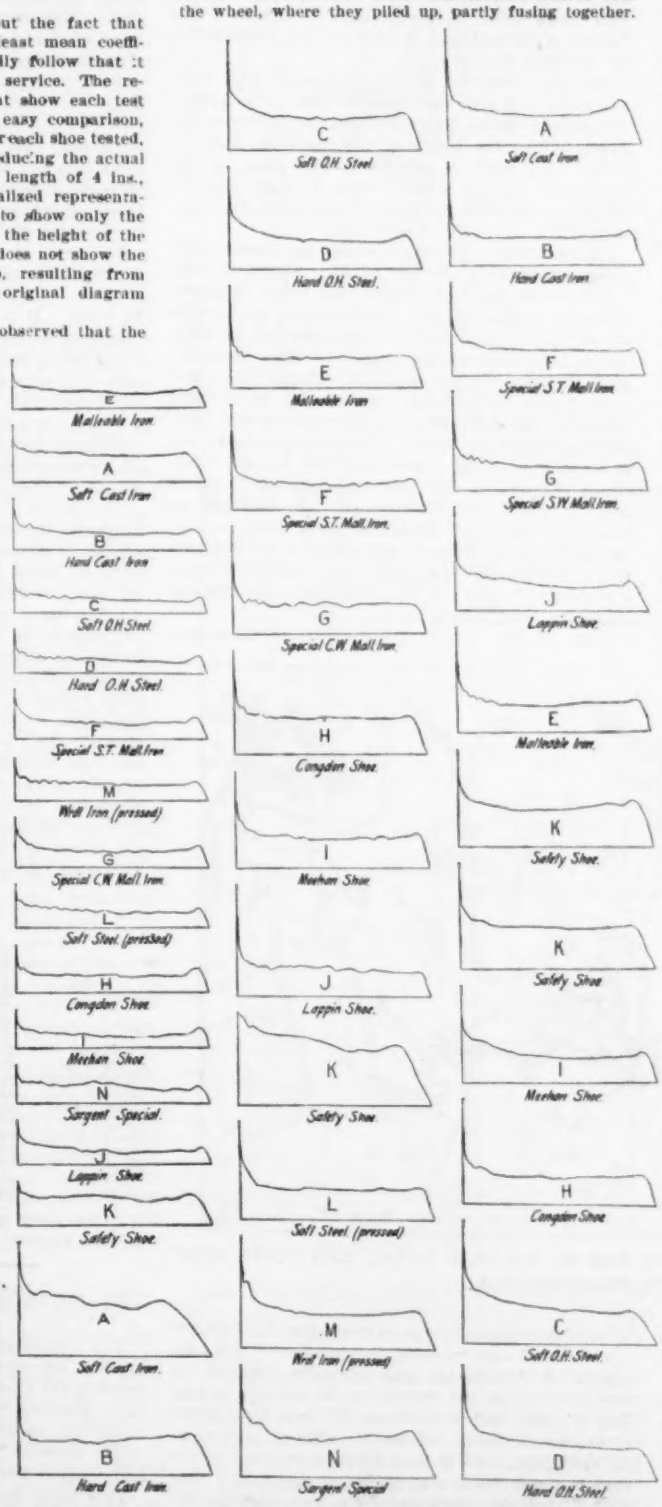
In analyzing the results it will be observed that the prevailing practice in the United States in the matter of brakeshoes for freight service—namely, that of cast iron, is, generally speaking, not far from the best yet known. The shoe K, it will be seen, compares very favorably with soft cast iron, but for reasons shown by the note on the test of this shoe, to be presented later, it is hardly practicable for use in its present form. In the case of the passenger tests with a chilled cast iron wheel, cast iron shoes give the best, or among the best, coefficients. In the case of the passenger tests with a steel-tired wheel, the relation is somewhat changed, steel and wrought iron shoes giving the highest coefficients.

The following notes taken after each test of the different shoes are presented to show the characteristics and incidents that could not be shown otherwise. In some cases the characteristics were such as to operate much to the disadvantage of some of the shoes that gave the highest friction coefficients.

Freight Tests.—In the case of all the shoes, excepting H, I and K, the surfaces were found to have a good bearing, sustaining no injury, neither were there any marked peculiarities of surface. In the case of shoes H and I, the wrought iron and steel insets flowed slightly, partially covering up the cast iron parts of the shoes. Shoe K, it will be seen from the diagrams, gave a more uniform friction than any of the others, and it did not give the sudden rise at the end of the stop. It is a question how much of this was due to the wooden insets, and how much to the very soft iron of which the shoe was made. There was no wear of the wheel after any of the shoes had been tested, although the surface was a trifle rough, due to small particles from the various shoes sticking to the tread; these, however, were easily scraped off. At no time was the wheel so hot that the hand could not be held on it without discomfort, although the shoes, in some cases, heated considerably, but not enough, it was thought, to affect their retarding power.

Passenger Tests, Cast Iron Wheel.—All of the shoes were fitted to the wheel accurately before commencing these tests. After the tests it was found that shoes A, B, E, F, G, J and K did not have a full bearing at the ends, about 85% of the total surface only having a bearing on the wheel. This was undoubtedly due to the intense heat generated by friction, which expanded the surface of the shoe in contact with the wheel and had a tendency to straighten it out, and thus make the bearing surface smaller. All of these shoes became red hot for a distance of about ⅛-in. up from the tread of the wheel during a single test, and from 20 to 30 minutes were required to cool them down with an air blast. The wheel also became warm, and after every five tests was allowed to cool down to nearly its normal temperature. Shoes A and B showed no other peculiarities than those above mentioned.

In the case of shoe C, the metal flowed under the intense heat and pressure, and the particles were carried to the end of the shoe which was last in contact with the wheel, where they piled up, partly fusing together.



DIAGRAMS SHOWING RELATIVE FRICTION OF DIFFERENT BRAKESHOES TESTED BY THE MASTER CAR BUILDERS' COMMITTEE ON LABORATORY FESTS OF BRAKESHOES.

(Ordinates of the Curve Show Amounts of Friction.)

Committee: S. P. Bush, J. W. Cloud, D. L. Barnes.

Shoe D had peculiarities very much the same as shoe C, but not quite so marked. With shoe H, the wrought iron insets flowed over the cast iron in flakes about 0.02 in. thick, separating the cast iron from the wheel and reducing the area of contact of the shoe about 25%. The shoe heated somewhat more than in the case of cast iron and malleable iron.

In the case of shoe I the steel insets flowed in the same manner as with shoe H, but to a greater extent, although the area of contact was about the same. Shoe J, which was of chilled cast iron, became red hot, during the test, and lost its chill entirely. After the tests, and the shoe had been cooled off, the face of the shoe could be cut easily with a file, while before the tests an emery wheel was required to cut the surface. After the chill has been removed the shoes might be expected to give the same result as hard cast iron. Shoe K was composed of very soft cast iron, fitted with wooden insets 1 1-16 in. in diameter. These insets reduced the cross-section of the cast iron part of the shoe 49.4%, which, combined with the softness of the iron, made it very liable to break. A crack appeared during the test of this shoe, which increased with each application of the brake, and at the end was so large that a light blow of a hand hammer broke the shoe in the middle where the crack was. The heat charred the plugs badly around the edges, and after this had taken place they did not present their entire section to the tread of the wheel; they also worked loose, and in practice would no doubt be liable to drop out when the shoe had been worn to about one-half its thickness.

Shoe L, soft-pressed steel. The metal in this shoe flowed, but not to the same extent as with shoes C and D. It presented its full surface to the wheel both before and after the tests. Shoe M, wrought iron. The metal flowed somewhat more than in the case of shoe L, but not so much as in the cases of shoes C and D. It presented a full bearing to the wheel after the tests. Shoe N was composed of cast iron, with chilled-iron insets, which were loose in the body of the shoe. These insets reduced the section of the cast iron about 56%. It gave no marked peculiarities.

Passenger Tests, Steel-Tired Wheel.—In these tests all of the shoes became much hotter than with the cast iron wheel, although there was but little difference in the temperature of the two wheels.

In the case of shoes A, B, E, F, G and J the characteristics were very much the same; the iron in all of them was torn off in flakes varying in size from ⅛ sq. in. to ½ sq. in., and in thickness from .0015 in. to .002 in. The largest flakes came from shoes E, F and G, and the smallest from shoe B, varying with the hardness and toughness of the different irons. Shoes C and D, soft and hard steel respectively, gave results similar to when tested with the cast iron wheel, but more marked, and in addition when the metal flowed it piled up in a very peculiar manner, preventing contact with the wheel at the end of the shoe last in contact with it. When these shoes were examined at the end of the tests, only about 70% of their surfaces were in contact with the tread of the wheel. Shoes H and I gave about the same results as with the cast iron wheel, excepting that the metal flowed somewhat more and covered more of the cast iron surface.

Shoe K broke during the second test. Another one was substituted, and this cracked so badly after the second test that it was broken with a hand hammer. This shoe, it will be observed, gave a diagram very different from the other shoes. The friction was the highest of all at the beginning of the stop, and at the end did not increase so rapidly. The excessive vibrations, or jerks on the pull rod, also did not occur. These latter characteristics are good ones, but it is not certain whether these are due to the wooden plugs or the softness of the iron. Owing to the tests of shoes L, M and N not having been completed the committee is not able to introduce notes covering them in this advance report.

While the friction of the various shoes when used in connection with the steel-tired wheel was greater than in the case of the cast iron, as might be expected, the steel-tired wheel showed slight signs of wear in all cases. However, the wear of the wheel was not enough to be measured in any way. One very significant fact is presented by the results of these tests—namely, that the coefficient of friction, or retarding power, of brakeshoes is greatly reduced under the conditions existing in passenger service, corresponding to the passenger tests. While the brakeshoe pressure in the case of the latter was increased nearly 300% and the speed about 60%, the coefficient of friction up to within a few feet of the end of the stops decreased about 50%. This presents a condition which indicates that considerable further information is required.

In the report presented by your committee last year, it was suggested that in addition to determining the relative values of the different brakeshoes when subjected to the ordinary conditions of service, much additional and exceedingly valuable information might be obtained in the way of determining the exact variation in friction under different conditions of brakeshoe pressure and speed. The apparatus that has been provided is well adapted to the purpose; but such an investigation requires much more time than your committee has been able to devote to it thus far. One thing that should be ascertained, in order to make the

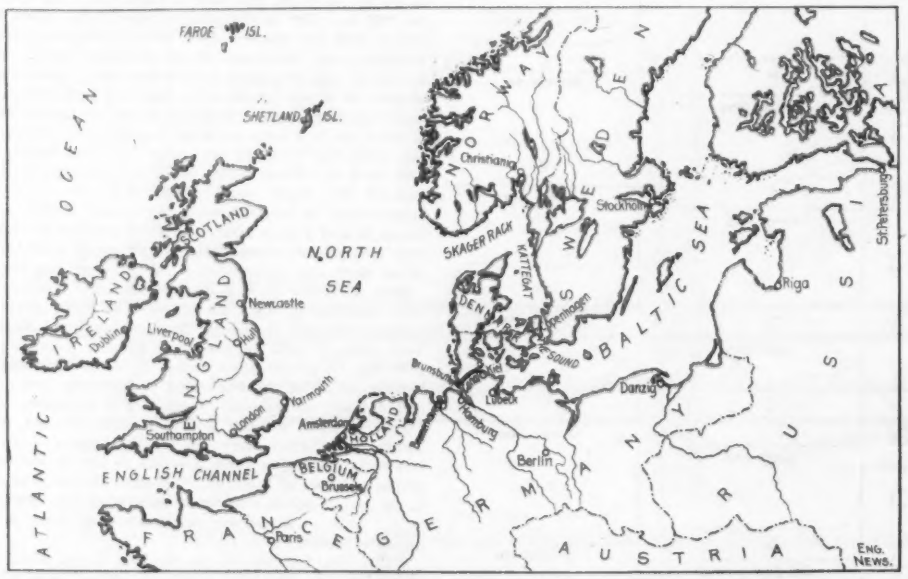
results obtained most useful, is the friction between car wheels and steel rails, on which depends the maximum braking power that may be applied to railway cars.

In carrying on its work your committee has been impressed with the fact that great variations in the retarding power of freight and passenger car brakes may result in service from the lack of uniformity in the friction furnished by the great variety of brakeshoes used, notwithstanding the fact that the brake gear, in all other respects, may be adapted to giving the best results. Much time has been devoted to the development of air-brakes and brake gear that will operate sucessfully within reasonable limitations, and it would seem that while certain standards have either been suggested or adopted by this association covering brakes, it would be entirely proper to extend limitations to brakeshoes as well. Your committee is not prepared to recommend anything in this respect at this time, but would present this matter, as well as others pointed out, for the further consideration of this association.

THE NORTH SEA AND BALTIC SHIP CANAL.

This canal, which is opened this week with impressive ceremonies to the traffic of the world, has been fully described and illustrated in all its engineering features in our issues of Aug. 1, 1891, and March 26, 1892, together with frequent notes of progress at later intervals. We will not, therefore, attempt to do more here than to present a brief review of its history and general description of the work.

The canal extends from the harbor of Kiel, near Haltenau, on the Baltic Sea, to Brunsbuettel, on the North Sea, where the estuary of the River Elbe has a useful least depth of 29½ ft. The distance across is approximately 61½ miles, and a single level is maintained between the double locks, with safety gates established at the two ends. The line of the canal is curved to adapt itself to the topography of the country traversed, with minimum curves of 1,000 m. radius and maximum curves of 3,000 m. radius.



MAP SHOWING POSITION OF THE NORTH SEA AND BALTIC SHIP CANAL AND PORTS MOST AFFECTED BY ITS CONSTRUCTION.

The normal section of the canal has a bottom width of 65.6 ft., a surface width of 183.7 ft. and a depth of 30.5 ft. These dimensions are based upon rules providing for the passage of a warship of 72.16 ft. beam and a draft of 24.4 ft.; and the width at keel-level is to be sufficiently great to pass with due care two ships of ordinary commerce of 38.4 ft. beam and 21.3 ft. draft. On curves of less than 2,500 m. radius the width of the canal is increased, according to the formula, $26 - \frac{\text{radius}}{100}$; the enlargement for 1,000 m. radius being 52.48 ft. The resistance to motion in this canal is but little more than on an open river.

In sections where stone is abundant, the sides of the canal are paved with 12 ins. of granite laid on 8 ins. of gravel. In other sections slabs of beton are used for paving, 8 ins. thick and 8.85 ft. long by 4.92 ft. wide. The locks are each 720 ft. long, with a useful length of 492 ft. and a free width of 82 ft. In design they differ little from locks usually used for similar purposes. The gates are handled by hydraulic power, and as the pressure on these large gates is very considerable, each gate has in it a supplementary relief gate, which is only shut down after the main gate is closed. This feature is claimed as a novelty in lock construction by the Chief Engineer.

The soil excavated was mainly sand, with some quicksand and peat underlaid by clay. The deepest cutting was at the divide between the Elbe and the Eider, where the banks of the canal are 65½ ft. high. The canal is crossed at this point by the Gruenthal railway bridge, with a single span of 513.3 ft., and with the lower chord 137.7 ft. above the surface of water in the canal.

In constructing the canal across the marshy sections, which were as soft as jelly, trenching was found to be impossible until the Chief Engineer devised a system of sand dams parallel to the axis of the canal. Light trestles were first put in place on the berm-lines of the canal, and from cars running on these trestles sand was dumped into place until it sank to the hard soil beneath. After these sand-dams were formed, the soft mud between them was excavated by dredges discharging outside the dams and the canal completed. The details of this clever engineering feat were given in our issue of Aug. 1, 1891, with illustrations. In building up some of these sand-dams, the track was laid on the sand bank as formed, and ahead of all was carried a floating platform, with track, supported upon a number of empty casks, and from this floating track the sand was dumped.

Near the Baltic end of the canal, at Suchsdorf, is another railway bridge carried over the canal at a sufficient height to allow the passage of ships beneath. A drawbridge was originally designed for this crossing, as the country in the vicinity is low. But it is said that the Emperor William II. objected to the possibility of cutting his railway in case of an emergency, and became his own engineer to the extent of ordering a high bridge at this point. This necessitated the changing of the line and the elevation of the railway roadbed for a distance of over five miles in length.

The total cost of the canal was about 156,000,000 marks, or $37,440,000. This is equivalent to $610,668 per mile. And a fact most uncommon in the history of works of this character is that this cost falls well within the original estimate of cost made by Chief Engineer Baeusch in 1886, notwithstanding the enforced change in plan at the Suchsdorf bridge, and the increased cost of that work.

Work was started upon the present canal on June 3, 1887, but a waterway along this general route was long ago made. In 1391-98, a shallow and tortuous waterway was excavated between the Trave and the Elbe, called the Strecknitz Canal, and connecting Lubeck with the Elbe. In 1525 another canal—the Alster-Trave—was built, and in 1777-84 the Eider Canal was constructed, forming a waterway from Holtenau, on the Bay of Kiel, on the Baltic, to the town of Tonning, on the North Sea. This canal followed the River Eider for most of the distance, and was hampered by six locks to overcome a 23-ft. rise in level in the 108 miles of its length. It was only 95 ft. wide by 7 ft. deep, but about 4,000 small vessels used it annually to avoid the passage around Denmark. Agitation for a deep canal, suitable for ships of a large size, commenced in 1864; but it was until July 16, 1886, that the Prussian Reichstag passed the decree authorizing the construction of the present ship canal for military and commercial purposes.

The canal is so constructed as to permit a speed of about six miles per hour, and the average time of transit through the canal should not be over 12 hours. It is figured that by adopting this route Hamburg steamers will save over 40 hours in time, and English steamers from all parts south of Harwich will save about 24 hours. It is supposed that the larger part of the vessels entering the Baltic will use the new canal, and some estimate of its traffic can be formed from the fact that the tonnage of vessels passing through the Sound in the summer of 1890 amounted to 300,000 tons per month.

The official description of the ship canal by Chief Engineer Baeusch contains a table, showing the saving in distances in nautical miles from various ports by using the canal. In this table a speed of 5.3 nautical miles per hour is assumed in passing through the canal, and a speed of 8.25 nautical miles per hour in the open water outside the canal. Three hours are allowed for detention at the locks, and the total distance in sea miles is counted from the ports named to a point beyond the Kiel mouth of the canal, where all the Baltic navigation routes intersect. This point is taken as opposite Moen, and the time allowance given is from the port named to this point of intersection, with the allowances mentioned of three hours. The contrasting routes and time are figured around the Skagen and through the Sound to the point opposite Moen. With this statement the table can be shortened as follows:

Port.	By canal.		By the Skagen.			
From.	Total distance to Moen, n. miles.	Total time to Moen, hours.	Total dist. to Moen, n. miles.	Total time to Moen, hours.	Short'g of route by using canal, n. miles.	Short'g of time by using canal, hours.
Hamburg.....	221.2	33.39	646	78.30	424.8	44.91
Bremerhafen..	272.2	39.58	595	72.12	322.8	32.54
Emden.....	346.2	48.55	629	76.24	382.8	27.69
Amsterdam...	450.2	61.15	687	83.27	236.8	22.12
Rotterdam....	479.2	64.67	716	86.78	236.8	22.11
Dunkirk.....	561.2	74.61	800	96.96	238.8	22.35
London.....	591.2	78.24	830	100.60	238.8	22.36
Hull.....	536.2	71.58	717	86.90	180.8	15.32
Newcastle....	591.2	78.25	698	84.60	106.8	6.36
Leith.....	646.2	84.91	730	88.48	83.8	3.57

In the above table all miles are German sea-miles, or 1.15 English land miles, or 1.885 kilometer.

THE CANADIAN CANAL AT THE SAULT STE. MARIE.

The Canadian Canal at the Sault Ste. Marie, opening up continuous navigation for about 2,384 miles in the Dominion of Canada, from the head of Lake Superior to the sea, was formally opened to traffic this week. This lock was described in detail in our issue of March 28, 1895; but a short resume and some comparative data follow:

This canal had its real beginning in 1798, in a wooden lock, built for the passage of bateaux by the Montreal Fur Company. The need of the new canal for the purposes of Canadian commerce were not very great, as the total amount of freight carried by Canadian craft in 1894 was only 3½% of the total carried through the St. Mary's ship canal. But Canada wanted its own canal for military purposes, and it felt the need of one in 1892, when the United States imposed special tolls on Canadian vessels at St. Mary's in answer to differentials al-

lowed to Canadian boats using the Welland Canal, with discrimination against American boats.

Work was commenced on the canal and lock in May, 1893, under a contract with Hugh Bryan & Co. A number of changes were made in the plans; but the lock as constructed is 900 ft. long in the chamber, 60 ft. wide, 60 ft. wide at the gates and 22 ft. deep below the lowest recorded river level. The masonry walls extend 1,106 ft. on each side, and they are 11 ft. wide on top, 20 ft. wide on the bottom, and around the gates they have a uniform thickness of 25 ft. There are three sets of gates at the eastern end; one is a guard gate, to be used only in emptying for repairs; one is a spare set, to be used in case of accident to the outer gate, the latter being in regular use. At the west, or upper, end, there is a main and a guard gate. The drawbridge over the Canadian lock has an opening of only 90 ft., as compared with a 200-ft. opening at the American lock, and fault is found with this narrow draw-opening.

The Canadian canal, cut through St. Mary's Island, on the north side of the river, is 18,100 ft. long with its approaches. Across the island the canal is 3,500 ft. long, 152 ft. wide at low-water level, and 145 ft. wide at the bottom. The low-water depth in this canal is 20 ft. Electric power will be used in handling the gates, and the total cost was about $4,000,000.

In comparison, the American canal now under construction has the following dimensions: Length of chamber, 800 ft.; width of chamber, 100 ft.; depth of water on miter sill, 21 ft.; estimated cost, $4,740,000. This new American lock, the largest in the world, was commenced in 1887 to supercede the old lock of 1855, and will probably be completed in 1896. Its lock capacity is equal to four of the largest lake steamers at once.

The purpose of these enormous locks is shown in the fact there are now engaged in the commerce of the lakes nearly 3,000 American steam and sailing vessels, representing an investment of $65,000,000, exclusive of barges and canal boats. To repeat an oft-quoted comparison with the traffic of the Suez Canal, we have the following statement of vessels and tonnage:

	1892.	1893.	1894.
Suez Canal.			
No. of vessels passing...	3,559	3,341	3,352
Tonnage, net registered.	7,712,028	7,659,068	8,039,106
St. Mary's Canal.			
No. of vessels passing...	12,580	12,008	14,491
Tonnage, net registered.	10,647,203	9,849,754	13,110,366

The longest lake routes are 900 miles, from Buffalo to Chicago, and 1,000 miles, from Buffalo to Duluth. The rate on grain runs about 60 cts. per ton, and the return with coal has been at the rate of 40 to 50 cts., and as low as 25 cts. per ton to Duluth. All this commerce is now conducted on depths not exceeding 16 ft., and in vessels of from 3,000 to 3,500 tons maximum capacity. A movement has been on foot for some years to increase the available water-depth to 20 ft., and the new lock at St. Mary's is being built upon this basis. Congress has already made appropriations to this end and contracts are let, and it is expected that by 1897 the 20-ft. depth will be secured. When this takes place vessels with a maximum tonnage of 5,000 tons can navigate between lake ports, and 50% more freight can be carried for practically the same cost per trip.

THE HARLEM RIVER SHIP CANAL.

The formal opening of the Harlem River ship canal at New York city on June 17 calls attention to this important, though comparatively small, piece of work, although it must be said at the outset that the term "ship canal" is liable to be somewhat misleading, the canal having a maximum depth of 18 ft. (only 10 ft. as yet in the dredged portions), and being crossed by a number of bridges. The canal is, in fact, intended mainly for boats and small craft.

The work consisted of the improvement and regulation of the Harlem River and Spuyten Duyvil Creek, both being tidal inlets, flowing into the East River and Hudson River, respectively, and separating Manhattan Island (upon which New York city is situated) from the mainland. This improvement provides a navigable waterway connecting the upper portions of New York Harbor, one important result of which will be to relieve the congested channel around the lower portion of the city from the heavy traffic of canal boats between the East River and Long Island Sound and points on the upper Hudson, as the passage of these tows seriously interferes with the ferryboats and general shipping traffic of the harbor. The relation of this navigable channel to the general plan of the harbor is shown by the small map, Fig. 1. The total distance from the East River to the Hudson by this new water route is about 7¼ miles, and the entrance from the Hudson River is 13 miles north of the Battery.

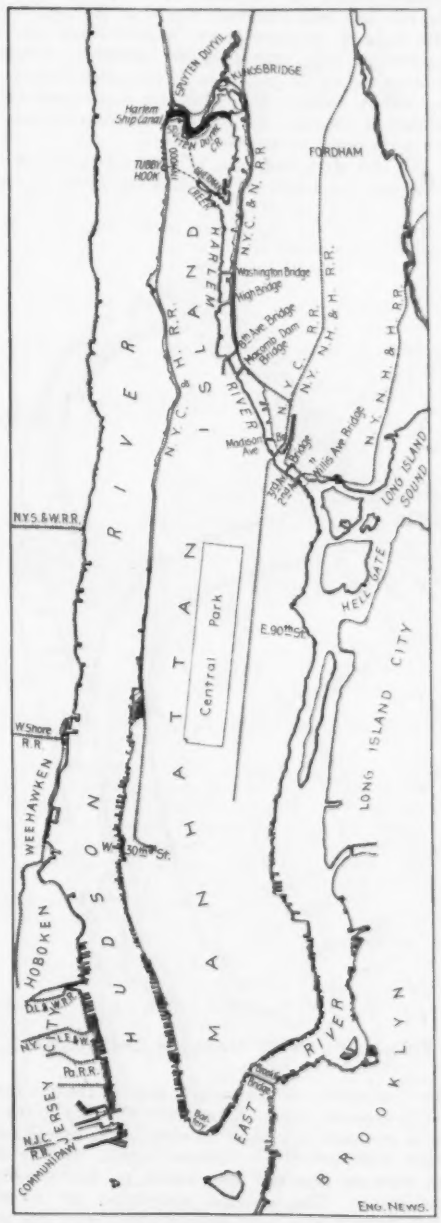


Fig. 1. Map of New York, Showing Location of the Harlem Ship Canal.

There has always been a water connection between the two main rivers, but its use for navigation has been prevented by a long ledge of rocks barely covered at mean low water, and by the extremely narrow channel at Kingsbridge. The head of navigation in the Harlem River at low tide was originally at High Bridge, five miles up, for vessels drawing 7 ft.; and the head of navigation at Spuyten Duyvil Creek at high tide was at Kingsbridge, 1¾ miles from the Hudson, for vessels drawing 8 ft. of water. The range of tides is 6 ft. in the Harlem River, near Kingsbridge, and 3.8 ft. in Spuyten Duyvil Creek. Tidal observations have shown that there is not a free exchange of tides betwen the two streams, but that there is practically a divide near Fordham bridge, the tides flowing in from the two rivers, and the following results have been observed: 1, The level of mean high water in the Hudson is 0.961 ft. lower than in the Harlem; 2, the mean rise and fall is 2.12 ft. less in the Hudson than in the Harlem; 3, the mean duration of rise and fall of tides in the former is 36 minutes shorter and 26 minutes longer, respectively, than in the latter; 4, high water occurs 94 minutes earlier in the former than in the latter; 5, the mean level of the Hudson at the mouth of Spuyten Duyvil Creek is 0.265 ft. lower than at Fordham bridge. Neither of the streams has a freshet due to rainfall.

In 1874, in accordance with an act of Congress, Gen. John Newton, then Chief of Engineers, U. S. Army, was directed by the Secretary of War to have surveys made for a canal, and as a result of these four routes were suggested, as follows: 1, From Sherman's Creek to Inwood or Tubby Hook, on the Hudson; 2, from Sherman's Creek to a bend of Spuyten Duyvil Creek, near Johnson's foundry; 3, by a cut through Dyckman's meadow, and, 4, through Spuyten Duyvil Creek by way of Kingsbridge. These are shown by dotted lines on Fig. 1. The third route was adopted as being the least expensive, the cut following the course of a small creek. It was intended to make a straight and direct cut, but the high valuation of the property of a large iron mill right on the line made it necessary to avoid this property by an awkward bend to the south. The project as originally adopted in 1875 was for a channel 350 ft. wide and 15 ft. deep at mean low water. In 1879 this was modified so as to increase the width to 400 ft. between pier and bulkhead lines in the Harlem River and Spuyten Duyvil Creek, retaining the original width of 350 ft. for the rock cut, but increasing the depth there to 18 ft. at mean low water. This was further modified in 1886 by narrowing the channel to a minimum width of 375 ft. immediately north of High Bridge, where it skirted the Ogden estate on the east bank; and again in 1893 by shifting the western pier line out 21 ft. for a distance of 1,630 ft. near Washington Bridge, to allow of the construction of the new speedway. Below the Third Avenue bridge the outer pier and bulkhead lines of the New York Department of Parks are followed. The cost of the work was estimated at $2,700,000, including $600,000 for removing rocks and boulders near the mouth of the Harlem River. The work was under Lieut.-Col. McFarland, U. S. Engineer Corps, in charge of this district, until his death in 1888, and has since then been under Lieut.-Col. G. L. Gillespie, U. S. Engineer Corps, to whom we are indebted for blueprints from which the map, Fig. 2, and sections, Fig. 3, are taken. The map shows the condition of the work in December, 1894. Mr. A. Doerflinger is the Assistant Engineer in local charge of the work. Much of the accompanying information has been compiled from the annual reports of Lieut.-Cols. McFarland and Gillespie to the Engineer in Chief of the U. S. Army.

The improvement of the Harlem River was easy work, consisting mainly of dredging the channel to the required depth. The banks of the river are comparatively high, but the margins of the stream are flat and marshy; these margins, like the bed of the river, being composed of alluvium, with an admixture of decayed vegetable matter resembling peat. This material is very soft and deep, as noted further on, and it is thought that the new banks will be eroded by the tidal currents if not protected by revetments; but no provision has yet been made for such protection on this part of the work. Rock outcrops above the plane of 15 ft. below mean low water at several points in the lower Harlem, near the East River, and occasionally groups of large boulders overlie the bed; but in general the bed is composed of mud, with an admixture of sand, and the banks are high and stable. The excavated material has been used to fill adjacent lowlands behind bulkheads, or has been towed out to sea, beyond Sandy Hook bar, a distance of about 30 miles. The bed of the improved channel in Spuyten Duyvil Creek is soft alluvium, and the banks are low and marshy, but near the Hudson River the bed is of loam, clay and sand, and the banks are high, ricky and stable. In the Harlem River and Spuyten Duyvil Creek, east and west of the cut-off or canal proper, the improved channel is

about 10 ft. deep at mean low water (or 15 ft. at high water) for a width of 140 to 160 ft., while in the bend opposite the iron works the cut has been dredged out to a depth of 12 ft. at mean low water for a width of 150 ft. The dimensions of the channels will eventually be increased.

It would have been the most economical method to carry on the work through the marsh south of the foundry and rolling mill at the same time as the rock cut through Dyckman's meadow, so that the excavated rock might have been used for the protection of the sides and bottom of the new channel through the marsh. Under the unsystematic practice of Congress in proportioning the amounts of appropriations, this could not be done, and in commencing the work it was therefore decided to apply the available appropriation to the excavation of the rock cut, and to store the rock on land leased for the purpose until the time when it would be required on the marsh channel.

The first contract for this work was awarded in December, 1887, to John Satterlee, at 93 cts. and $1.13 per cu. yd., respectively, for excavation above and below mean low water, including all dams and pumping. Two other contracts for an extension of the cut and for the removal of the section between the two main excavations, were awarded to the same contractor in June, 1889, and March, 1891, and the dates for the completion of the work on all these contracts were extended from time to time. The two latter contracts were never completed, owing to the breaking in of the water in 1893, and, as the work was nearly completed, the contracts were allowed to lapse, and the completion of the work under the changed conditions was executed under a separate contract with another firm, as noted below. Work on the first contract was commenced in January, 1888, two dams being built, and an inclined trestle erected for dumping the stone in a pile for storage. A short dam, built entirely of earth, was thrown across Dyckman's Creek, near the Kingsbridge road, to keep out the water of the Harlem River, and on the marsh at the Spuyten Duyvil end of the cut was built a long dam. This dam was composed of a double row of piles, with wooden braces and iron tie rods, and a continuous row of tongued and grooved sheet piling on the outside, and banked over with the marsh sod to a width of about 6 ft. on top. A pump was used to remove the mud overlying the rock at the western end of the cut, and to deposit it on the marsh, the water required being supplied and controlled by a flood gate in the larger dam. This dam gave considerable trouble, the soft mud underlying it moving into the cut as the work progressed, and the turf surface also moving with it broke away a section of the sheet piling about 200 ft. long, canting it over as much as 20 ft. at one part, and causing several breaks in the line of piling. To repair this break, a large quantity of broken stone was thrown in behind the sheet piling, and this settled down, carrying the turf with it like a mattress, until the broken part of the dam became practically a bank of stone with a facing of mud, turf and clay on the outside. This was secure, but continued to settle steadily, and required constant care and attention. On March 16, 1889, during a heavy northeast gale, the water of Spuyten Duyvil Creek broke over a low place in the top of this cofferdam, and flooded the whole cut and the large pump, so that work was stopped for ten days. Stormy weather, strikes, deficiencies in steam power and pumping machinery, etc., also caused delays, and on May 31, 1889, only 142,544 cu. yds. had been removed, instead of the total 300,000 cu. yds. included in the contract, and an extension of time was therefore granted. Similar reasons led to the extension of the other contracts, as already noted. Great difficulty was experienced at first in sinking a pit in the marsh deep enough to drain the work thoroughly.

The new dam built east of Kingsbridge Road to keep out the water of the Harlem River during

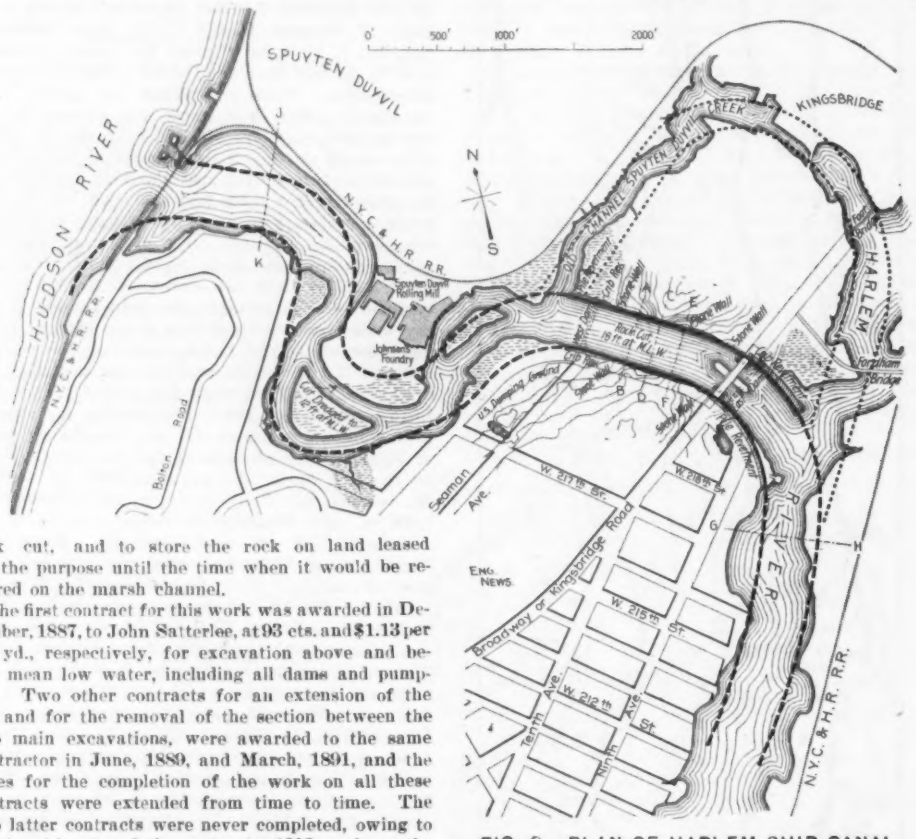


FIG. 2. PLAN OF HARLEM SHIP CANAL.

the construction of the eastern part of the cut (under the second contract), consisted of a line of sheet piling enclosed in a bank of earth, clay, gravel and stone, constructed in a dredged trench. It was 25 ft. wide on top, and rose to 10 ft. above mean low water. The material underlying the marsh at this point was very compressible, being the remains of an ancient vegetation nearly free from earthy matter, and this material extended down to bedrock, 45 to 55 ft. below the surface, except at the south end of the dam, where a stratum of hard sand and loam was met with. The settlement of the earth bank of the dam was naturally very great, amounting in some places to more than 17 ft. below the depth to which the trench was originally dredged. The sheet piling was also liable to be forced out of place after being driven by the great and unequal settlement of the bank, thus destroying its efficiency as a protection against leakage. This difficulty was overcome by first building a central core of the embankment in the deepest portion of the trench, and allowing it to settle thoroughly before driving any piles. Piles were then driven along the outer edge of this core, and the space on both sides of the piles filled in, after which they stood perfectly firm, as but little further movement could take place in the material surrounding them, it being confined on one side by the earth bank already in place, and on the other by the side of the excavated trench. These two main dams were about 1,200 ft. apart.

The western dam was again breached by high water in Spuyten Duyvil Creek on Oct. 24, 1890. The water filled the excavations at both ends of the cut, and forced the eastern dam slightly out of line, and repairs were not completed until March, 1891. A contract for removing the eastern cofferdam and dredging to the Harlem River was awarded to Lee McCallum in December, 1890; and a contract for removing the western cofferdam and dredging in the Spuyten Duyvil Creek channel was awarded to P. Sanford Ross in January, 1891. This work was to be done after the completion of the Satterlee contracts for the excavation between the dams. On April 21, 1893, during a severe northeast rainstorm, the water in the creek and the Harlem River backed up to a greater height than had ever been observed before during the progress of the work, and at flood tide both dams were breached and badly washed out. As the excavation contract was nearly completed, the dams were not rebuilt, a temporary bridge being built to accommodate traffic until the new drawbridge was built by the city. The excavation of the canal channel was completed and the remains of the dams removed by blasting and dredging, the contract for this work being awarded to the Morris & Cumings Dredging Co., of New York, in September, 1893, the contract also including 650 lin. ft. of crib work and 475 ft. of pile work revetment.

Owing to the peculiar stratification of the rock and the many seams and cracks running through it, the sides of the cut between the dams were very jagged and irregular, and to provide more regular and permanent sides, as well as to prevent loose rock and earth from falling into the canal, it was decided to build a masonry revetment wall along part of each side. The wall is about 4 ft. thick, with the rear face directly against the rock, and the height is generally 27 ft., or 9 ft. above low water, except where carried up to a height of 30 ft. to intercept an earth slope at its natural angle of repose. There are five lengths of wall, three on the north and two on the south side, aggregating 730 ft., part of the work being laid dry and part laid in cement, the cost being $2.50 and $6 per cu. yd., respectively. There are also 190 ft. of timber revetment.

The cut through the soft material of the marsh, shown in Fig. 3, caused considerable anxiety and difficulty. In 1887 a contract was let to J. E. Robinson, of Philadelphia, at 50 cts. per ft., for borings from near the end of Dyckman's Creek westward to the Hudson River, 141 borings being made to depths of 9 to 112 ft. These showed that a bed of semi-fluid mud 60 to 100 ft. deep existed on the line of the proposed cut, south of the rolling mill and Johnson's foundry, and that it would be necessary to protect the sides and bottom of the cut from erosion by the tidal currents. This mud was fluid enough to be pumped. For the purpose of such protection, experiments were made with a crib of round timber filled with stone, a mattress of round timber, and a covering of loose stone or riprap, the load being put on gradually, so as, if possible, to compress the substrata. The total length of the crib work was about 99 ft., with 1,929 cu. yds. of stone filling, and the estimated pressure upon the bed of the creek was 1,600 lbs. per sq. ft. The cost for this was $46 per lin. ft., exclusive of dredging the trench for the crib. The mattress was about 98 ft. long and 41 ft. wide, loaded with 1,697 cu. yds. of stone, and its cost was about $22 per lin. ft. The settlement was slow, the mud at this point being stiffer than expected, and stiffer than it was known to be in the marsh south of the foundry and rolling mill. A pit was sunk in the marsh, and showed that the turf extended down 6 ft. below the surface, or to about 1 ft. below the plane of mean low water, and had considerable consistency, but underlying it there was a soft grayish mud, almost fluid, which apparently extended to the rock, 70 ft. below. In order to obtain information as to the possibility of compressing this soft mud, test borings were made in the yard of Johnson's foundry, where the cinders from the furnaces had been dumped on the marsh, and loaded with piles of coal and pig-iron. At a point where the rock was about 19 ft. below the plane of mean low water no turf was found above an elevation of 5 ft. below that plane, though its original elevation, before being weighted, was about 5 ft. above, and there

was no apparent raising of the turf of the adjoining marsh. An experiment was also made by piling broken stone on the north side of the proposed channel. It was considered that if the experience at the foundry yard was to be relied on, there was little doubt that a strong bank could be formed, which could be used as a protection to the sides of the channel or the backing of a bulkhead, with perpendicular face, where it was necessary to retain the full width of the channel without trespassing on the land of riparian owners. As already noted, however, no provision has been made for revetment on this part of the work, but only for such timber work and stone work revetment as is absolutely required for the protection of the cut across Dyckman's meadow.

There are numerous bridges over the new waterway, and we are indebted to Lieut.-Col. G. L. Gillespie, U. S. Engineers, for the following corrected list of these bridges, as numerous changes are being made.

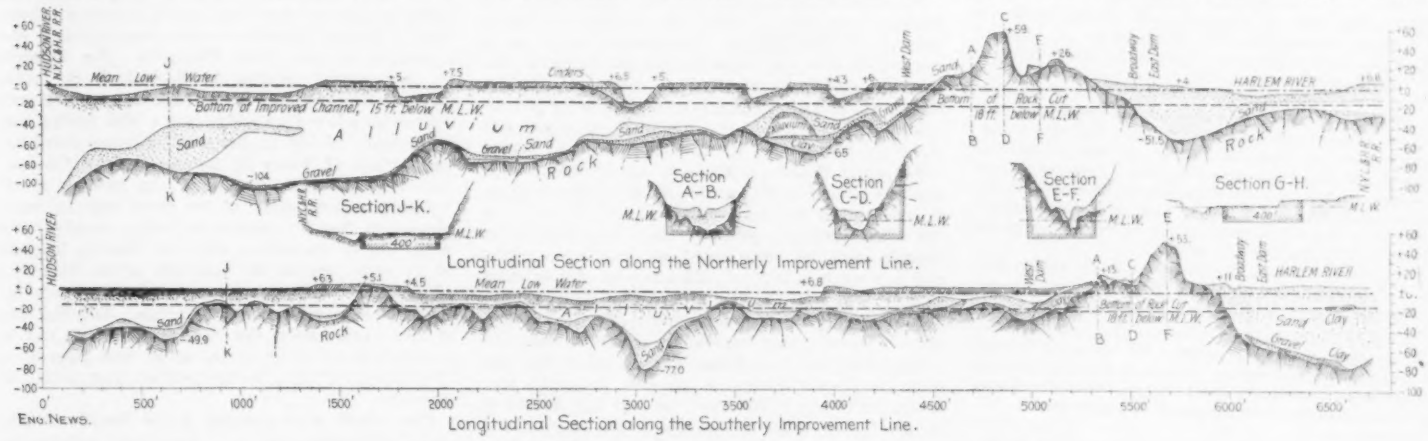


FIG. 3. PROFILES AND SECTIONS OF HARLEM SHIP CANAL.

Thus the Third Ave. bridge has been torn down to make way for a new one, being replaced meanwhile by a temporary bridge; and the New York Central & Hudson River R. R. bridge at Fourth Ave. is also to be replaced by a high-level bridge, as already described in this journal. The table of bridges is as follows:

Bridge.	Clear width of draw. ft.	Clear height above M. H. W. ft.	Remarks.
Second Ave.	103.7	28.5	Dble.-draw railway bridge, iron
Third Ave. (temporary)	61.0	4.0	Dble.-draw, wooden trestle, iron drawspan
Fourth Ave. "	60.1	1.0	Single-draw, " " " "
Madison Ave.	132.0	28.0	Dble.-draw, road bridge, iron
Macomb Dam, 155th St.	164.0	28.0	" " " " ; opened May 1, 1895
" " 156th " (temporary).	76.0	16.7	" " " wood; will shortly be removed; draw now permanently open
Eighth Av. Bridge (N. Y. & N. R. R.)	128.0	28.0	Dble.-draw, railway bridge, iron
High Bridge (aqueduct)	....	....	No draw; stone arch; 77.7 ft. between piers; 55 ft. clear waterway; crown of arch 100 ft. above mean h. w.
Washington Bridge, 181st St.	....	....	No draw, iron arch 500 ft. span, 420 ft. waterway, 136.7 ft. to crown of arch
Farmers' Bridge	....	3.1	No draw, two spans 22 and 23 ft. wide, light timber structure
Kings Bridge	....	4.8	No draw, two spans 18 and 25 ft. wide
Broadway Bridge (over canal)	104.0	26.0	Dble.-draw, road bridge, iron; opened Jan. 1, 1895
Spuyten Duyvil Creek Bridge (N. Y. Central R. R.)	50.0	6.9	Sgle-draw, wooden trestle, iron drawspan; will shortly be replaced by iron truss bridge with dble. drawspan

Lieut.-Col. McFarland, in his report for the fiscal year 1887, discussed the commercial advantages of this new waterway as follows:

The prospective value to commerce and benefits to the community to follow completion of the proposed improvement may be considered under two heads. First, the extension of available water front and the development of local trade. The proposed improvement when completed will provide for an addition of about ten miles of wharves to the water front of the city of New York, relieving such districts as are now overcrowded, and accelerating the tendency of traffic of building materials toward the Harlem River as a distributing point for the growing sections of upper New York. The value of this particular item of the commerce of the Harlem for the past year is estimated at $2,759,850.

Second, economy in transportation. The Harlem and other distributing points on the East River will be brought nearer the coal, brick and lime depots of the Hudson River above Spuyten Duyvil, but the traffic will be limited practically to barges and canal boats in tow of steam tugs. The preponderance of opinion held by shippers and boatmen is against the probability of the new route being used by traders between the Hudson River and eastern states, because of the several bridges crossing it. The principal distributing point for bricks by the cargo is at the foot of Thirtieth St., North River. Harbor towage of an ordinary brick barge, loaded, from that point into the Harlem River below Second Ave. bridge, and back light, is $20. Cutting through the Hudson River would make the mouth of the Spuyten Duyvil a more natural point of distribution. The average cost of towing from the Hudson to 90th St., East River, by the new route, would be reduced 50%.

	Miles.
From the mouth of Spuyten Duyvil Creek to High Bridge, by the Battery and East River	23
By the new cut	3½
From the mouth of Spuyten Duyvil Creek to 90th St., East River, by the Battery	18½
By the new cut	8
From Weehawken to the tidewater terminus of the N. Y. & N. E. R. R. and N. Y., N. H. & H. R. R. on the Harlem River by the Battery and E. R.	18
By the Hudson and the new route	11
From Jersey City and Communipaw, by the Battery and E. R. to the same point on the Harlem.	13
By the Hudson and the new route	16

The movement of coal from Weehawken for local consumption on the Harlem will be benefited, but the Sound trade from that and other points south of it will be most likely to follow the old route through the East River. There is, however, a large and increasing floatage of railway scows in and out of the Harlem from Weehawken, Hoboken and Jersey City, connecting the railways of New York and Pennsylvania with those of New England.

The difference in the distance from Weehawken in favor of the new route removes all doubt about its use. From Jersey City and Communipaw the distance by way of the Hudson River would be somewhat longer, but the difficulties and perils arising from the stronger currents and crowded local and Sound traffic in the East River more than equalize distances and favor the new route. It is also believed that the shipment of all ice from the upper Hudson to points on the East River above the Battery will be through the Harlem. This movement has been estimated reliably at 500,000 tons, or $750,000, per season.

The benefits and advantages to follow the specific joining of the Harlem River and Spuyten Duyvil Creek, thereby connecting the Hudson and East Rivers, may be summarized as follows: First, provision for extension of water-front and addition of about ten miles of wharves and docks to the commercial facilities of the port of New York; second, economy in transportation of about 1,642,158 tons of merchandise, valued at $17,511,541, over distances varying from 1 to 23 miles.

The commercial statistics given in the report of Lieut.-Col. Gillespie, for the fiscal year ending June, 1893, showed the following amount of commerce on the Harlem River to 220th St., about 8 miles, and on the Spuyten Duyvil Creek to Kingsbridge, 1¾ miles:

	Tons.	Dollars.
General merchandise	3,232,052	159,635,435
Grain, flour, feed, etc.	591,391	15,147,478
Lumber and timber	451,702	7,402,403
Building material	602,217	2,701,100
Fuel	878,234	4,573,836
Ice	149,865	339,460
Total	5,910,376	190,149,712

The total tonnage showed an increase of about 75% over the year 1890, the increase being largely due to the increased amount of freight handled at the docks of the New York, New Haven & Hartford R. R., directly below the Second Ave. bridge, where 3,243,850 tons were received and shipped (as against 1,407,882 tons in 1890); while 166,690 tons were received and shipped at the docks of the New York & Northern R. R., near High Bridge. Of the balance, 2,475,275 tons were distributed at various points on the Harlem River, and 25,185 tons at various points on Spuyten Duyvil Creek. A large proportion of the freight handled at the railway docks is carried on car floats and transfer boats, connecting the railways of New Jersey and Pennsylvania (terminating at Weehawken, Hoboken and Jersey City) with those of New England, while the general commerce of the river is carried on mainly in barges and canal boats in tow of steam tugs, and in schooners and the smaller class of sailing vessels. The traffic on the river in 1893 was carried by the following vessels:

Canal boats, barges and railway car floats	20,361
Sailing vessels, schooners, lighters, etc.	4,476
Steamers and tugs (exclu. of naphtha launches)	15,241
Total	40,078

LEGAL DECISIONS OF INTEREST TO ENGINEERS.

Indictment of Municipal Officers for Maintaining Nuisance.

A borough on which is imposed the duty of making regulations necessary for the health and cleanliness of the borough may be indicted for permitting its sewers to become a public nuisance. In such a case an indictment against B as burgess, and K and others as councilmen, of the borough of L. for maintaining such a nuisance is an indictment against them in their official capacity, and not as individuals. Where borough officers, in their official capacity, are convicted of maintaining a nuisance, and ordered to abate the same, the fact that they afterwards retire from office is not sufficient reason for not enforcing the sentence requiring them to pay the costs.—Commonwealth v. Breeden and others (Supreme Ct. Pa.), 30 Atlantic Rep., 921.

Duty of Street Car Company in Relation to Its Tracks.

The railway company having received the benefits and advantages of the corporate franchise from the city, under the provisions of the ordinance (requiring it to keep its track in proper repair, and graded so that other vehicles could turn in and out, etc.), it was its contract duty to so lay and maintain its rails that carriages could easily and freely cross its track, and this includes the duty of filling up outside its rails (when the earth becomes worn and washed away), so as to make safe connection between the tracks and the balance of the street, and this is a continuing duty under the terms of the ordinance.—Baumgartner v. City of Mankato (Supr. Ct., Minn.), 62 N. W. Rep., 127.

Leakage of Gas Main.

Where a natural gas company pays judgments obtained against it for damages caused by an explosion resulting from leakage of its mains, it may recover the amount of same from a traction company which made excavations about the mains, and filled the same in so negligent a manner as to allow the mains to settle and cause the leakage.—Philadelphia Co. v. Central Traction Co. (Supr. Ct. Pa.), 30 Atlantic Rep., 934.

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The action of the Master Car Builders' Association in appointing standing committees to make tests of triple valves and other air-brake fixtures, and to report on the use of the standards of the Association is one to be commended in every way. A vast amount of information has been collected by the committee on air-brakes and an elaborate plant constructed for testing purposes, and it would seem eminently desirable that the fruits of this labor should continue beyond the various reports which have been made to the Association. By having a standing committee to make tests of new air-brake apparatus put onto the market, and to offer advice and suggestions to members intending to purchase air-brakes, the Association will reap a benefit which it could hardly get in any other way. A standing committee on standards is even more desirable. It is an open question at the best as to how far any engineering society should commit itself to definite standards in mechanical construction. In the majority of cases its effect is entirely vicious, and it is always attended with danger. No one will question that the Master Car Builders' standards have been of great benefit in establishing uniformity and interchangeability in parts of cars, but the Association is beginning to learn of the dangers attending the practice. Already it is finding that certain of its standards adopted from year to year are inconsistent with one another, or are adaptable to special conditions only. The appointment of a standing committee to inquire into the extent to which the standards are being used, and to investigate complaints and to suggest changes or modifications to the Association is, therefore, necessary if the best results are to be obtained from the adoption and use of its standards by the railways. An intelligent committee can be of great benefit to the Association in this capacity.

Another point which cannot be passed over without some further mention was the suggestion made by President Lentz in his opening address, that the Association prepare plans and specifications for 80,000-lb. capacity freight cars. It was only a few years ago that 60,000-lb. cars were looked upon as being about the limit of weight and capacity advisable for freight service, and already we have a warning that cars ten tons larger are coming. As a matter of fact, indeed, 80,000-lb. cars have already been built by a number of railways. This means more than that heavier cars are to be built; it means heavier loads on tracks and bridges, and heavier maintenance of way expenses throughout. Already our prominent railways are adopting 75-lb., 80-lb. and even 100-lb. rails to carry the present loads, and the indications are that in a few years only the heaviest of these rails will be suitable for the loads that will be hauled over our railways. With these must come more solid roadbeds, better ballast and better permanent way and track throughout. It has been a somewhat peculiar circumstance in the improvement of roadbed and track on American railways that it has followed, as a matter of self-defense almost, the development of the rolling stock, while in Europe the roadbed and track have always been far superior to the demands of the rolling stock upon them. It would seem as if the practice of the future in this respect in America is to be a repetition of the past.

Street railways have no exclusive rights over city bridges, according to the late decision of Judge Thayer, of Philadelphia. The question came up in connection with the claim for exclusive rights over the Callowhill St. bridge in that city, by one of the street railway companies already in possession. Another company attempted to cross, but the right was denied by the older company under the General Passenger Railway act of 1889. This act was passed to prevent the public nuisance likely to arise from several companies laying tracks on the same street; it provides that no extension or branch shall be constructed on any street upon which a track is laid or authorized by any existing charter. But a proviso grants the right to use 500 ft. of another company's track in order to complete a circuit, upon reasonable compensation. In interpreting this law Judge Thayer ruled that the company already having a line over the bridge had no exclusive right; but that the city had authority to give more than one company the use of the bridge for the completion of its circuit. The ruling is of considerable importance in cities divided by bridges, and is in the line of promoting public convenience by denying exclusive individual rights across structures built by and for the use of the public.

A beginning has been made in what may prove the extended use of electrically-operated roads as feeders, instead of rivals, to steam railways. The Pennsylvania Railroad Co. has substituted electric motors for locomotives on the seven-mile branch line connecting Mt. Holly and Burlington, on its New Jersey system, and it does this in the interest of greater economy. This branch was a costly one to operate with a steam equipment; but with light combination cars running on the old track, a speed of 34 miles per hour has been attained, and the experiment promises to convert a non-paying property into a profitable one. This seems to be a logical and natural outcome of the development of electric traction; and while the latter will not yet serve for heavy traffic and long distances, for which service the steam railway has great advantages, there are doubtless many short branch roads in the railway system of this country to which the new power can be applied with a decided gain in operating expenses, as compared with older methods. Electric traction is already serving a good purpose on feeders to main trunk lines operated by steam in various parts of the country, and its use in this connection can, and doubtless will, be extended. At the present time competition is sharp between the old steam lines and parallel but independent trolley roads, and the railway corporations are bitterly fighting this competition and loss of local traffic in the courts and state legislative bodies. It is undoubtedly for the ultimate interest of all concerned that laws should be made to sharply define the rights and privileges of the two systems of transportation where these compete, and such laws will come as the true bearing of electric traction upon transportation problems in this country is better appreciated. But the experiment of the Pennsylvania Company, and a similar solution now being discussed by other old railway companies, would seem to point out a scheme of profitable combination of the two systems under one management. Both systems have their field of operation, and though some change in the railway laws may be necessary before the two can be legally combined, this utilization of the new motive power as an adjunct to the old seems to be near at hand.

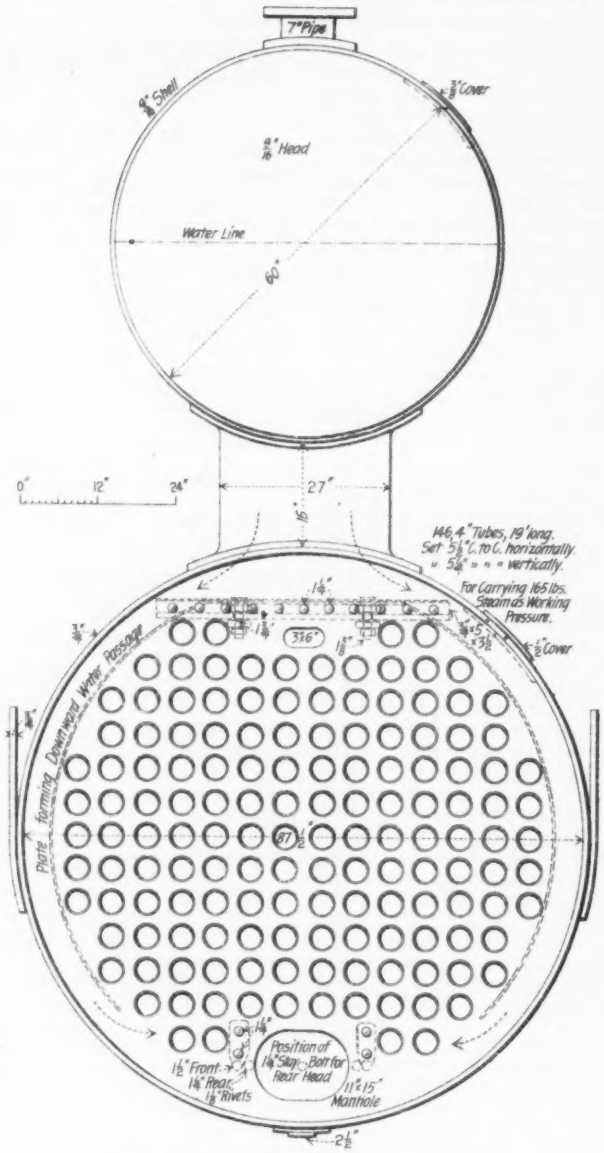
The North Sea and Baltic ship canal was opened this week to the commerce of the world; and in enabling merchant vessels to avoid the dangers of the longer passage to the Baltic by way of the Skagen and the Cattegat, its builders have done the trading world inestimable service. The ship canal shortens by many miles and hours the passage from the North Sea to the Baltic, and though the present Emperor of Germany evidently lays great stress upon its military importance, its value to the commercial world is none the less real. In its planning and its construction there is one unusual feature that deserves more notice than it receives. That is, that in an enterprise costing over $37,000,000, the estimates of this cost, made in 1886, have not been exceeded. This is the more remarkable because changes have been made in parts of the work which certainly necessitated a greater expenditure than was originally contemplated by the Chief Engineer. For example, at the railway crossing at Suchsdorf, the young German Emperor turned engineer, and insisted upon converting a low drawbridge into a high bridge, with a clearance of 138 ft. between its lower chord and the surface of water in the canal. The fact that this higher bridge demanded the raising of the railway on both sides of the canal and an entire change in line for nearly six miles, weighed little with him in connection with the possible blockade of the canal against his ironclads, or the blockading of a military railway in an emergency by some accident or damage to the drawbridge. The Engineer of the canal made the change required, and so economized on other parts, or so well figured his "contingencies" that he nevertheless kept within his estimate.

This record is so unusual in the history of ship-canal enterprises that it is practically unique: but it is gratifying to realize that such an outcome is a possibility under careful and exhaustive preliminary planning and honest and painstaking administration during construction. As near as we can learn, this administration has been unusually efficient. In the simple means devised for building this canal through jelly-like marshes, the engineer proved his ability to cope with unforeseen difficulties—an attribute which is one of the most conspicuous marks of a great engineer.

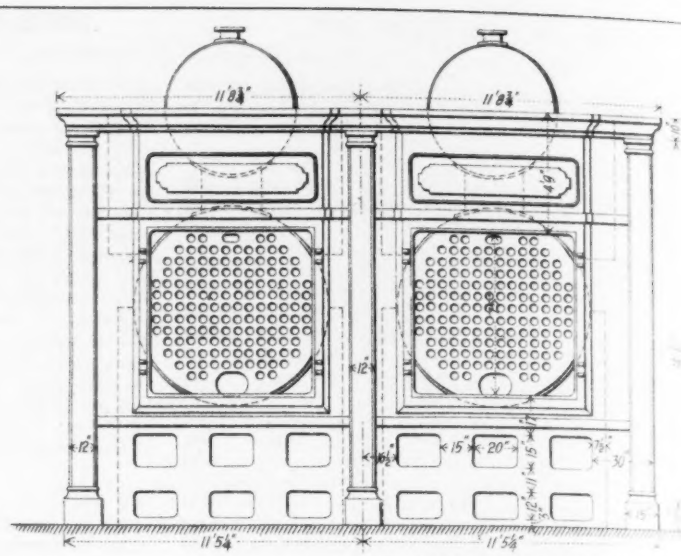
The whole record of work on this canal is in striking contrast with the engineering inefficiency and official rascality that wrecked the Panama enterprise. It may be said that this Baltic Canal was comparatively easy, with its single level and shallow summit cutting. But it did involve engineering difficulties that might easily have swamped the estimates of a less careful engineer in view of the many millions involved, and too much credit cannot be given to Engineer Baeusch for his faithful and able work as designer and director from start to finish.

Two other canals also have their commercial beginning this week: the Canadian canal, at the Sault Ste. Marie, and the Harlem canal, around the upper end of Manhattan Island. The first-named gives to Canada a continuous waterway from the head of Lake Superior to the sea, and was described in its technical features in our issue of March 28, and is briefly sketched elsewhere in the present number. The other, the Harlem canal, effects a navigable waterway across the upper end of New York, and by connecting the North and East Rivers at this point relieves the congestion in traffic at the lower end of the U-shaped harbor. It is intended for canal boats and small craft only; its channel being 400 ft. wide, with a depth of 15 ft. at low water.

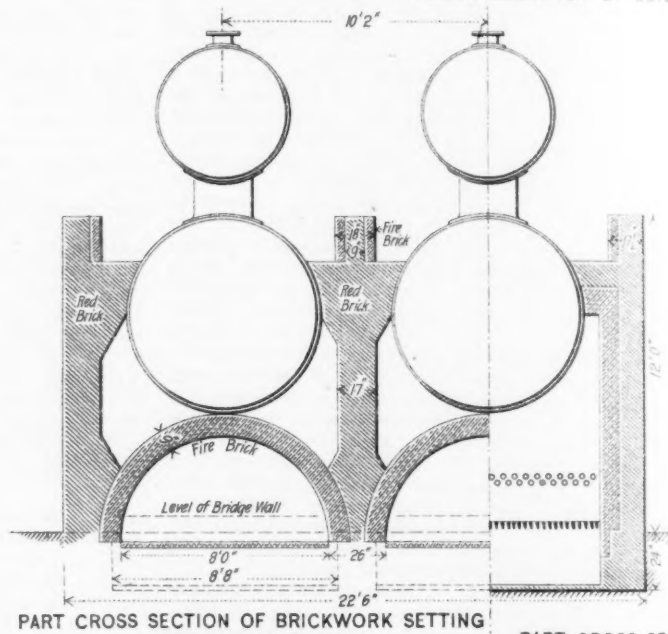
Mr. Mark W. Harrington, Chief of the U. S. Weather Bureau, lately read before the Philosophical Society of Washington a paper upon Central American rainfall that has a decided bearing upon ship canal construction in that region. He bases his deductions upon somewhat limited data, as stations for rainfall observation are scarce in that country; but reliable observations have been made for some years, especially at San Jose, in Costa Rica, and at Rivas, in Nicaragua. Coupling these with the records of the engineers of the



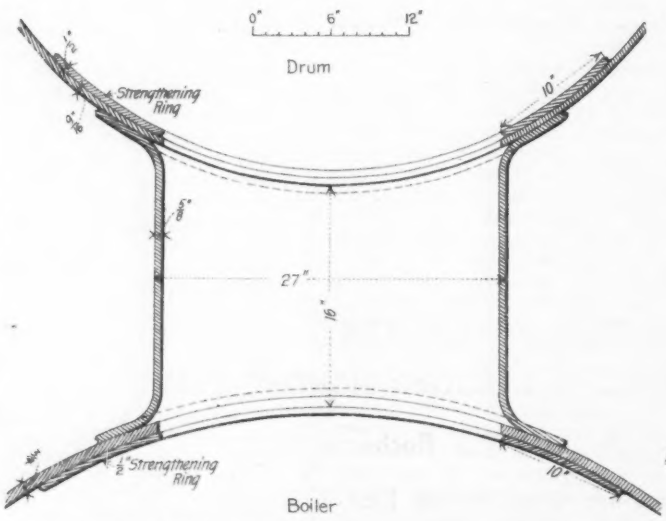
FRONT ELEVATION OF BOILER AND DRUM.



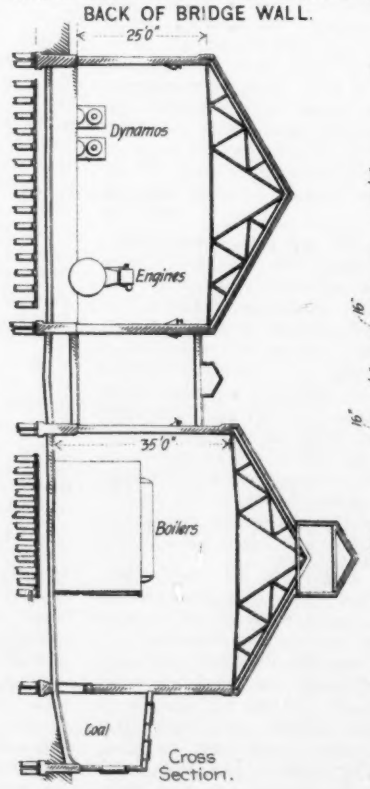
FRONT ELEVATION OF BOILER CASING.

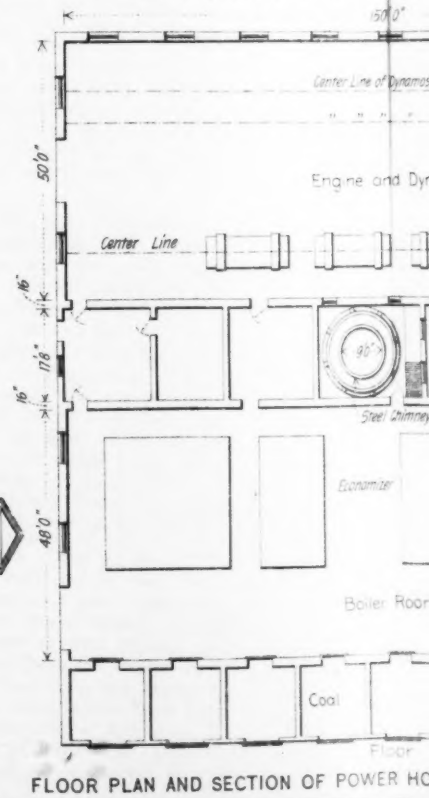


PART CROSS SECTION OF BRICKWORK SETTING BACK OF BRIDGE WALL.

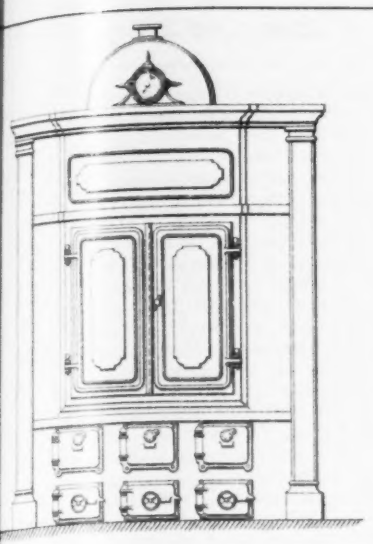


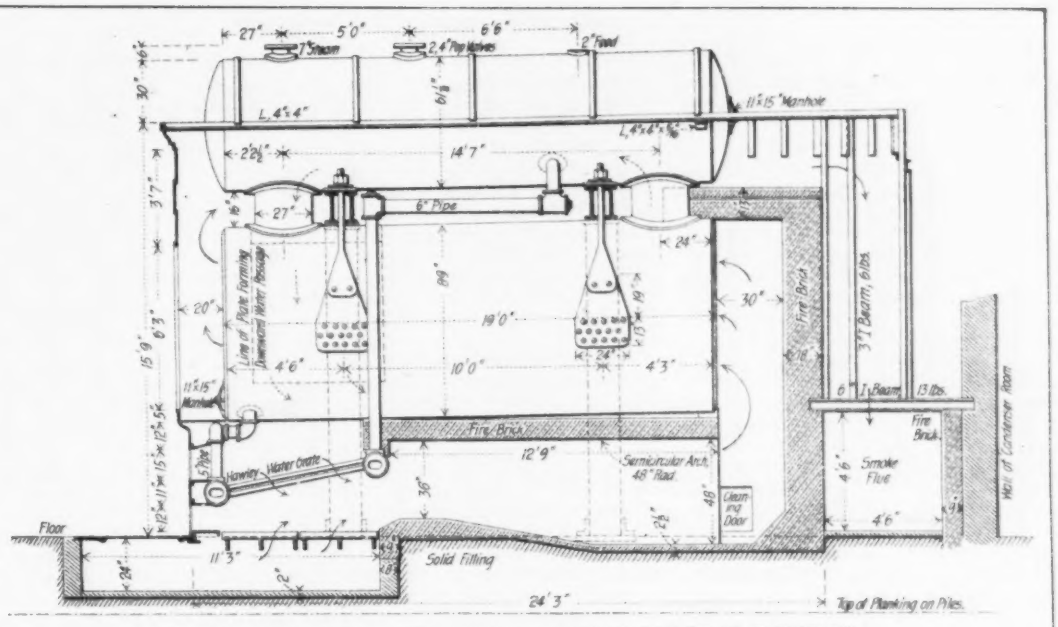
VERTICAL SECTION THROUGH CENTER OF NECK.



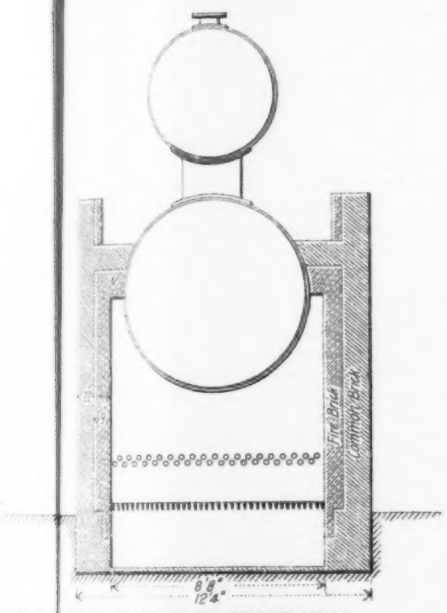


FLOOR PLAN AND SECTION OF POWER HO

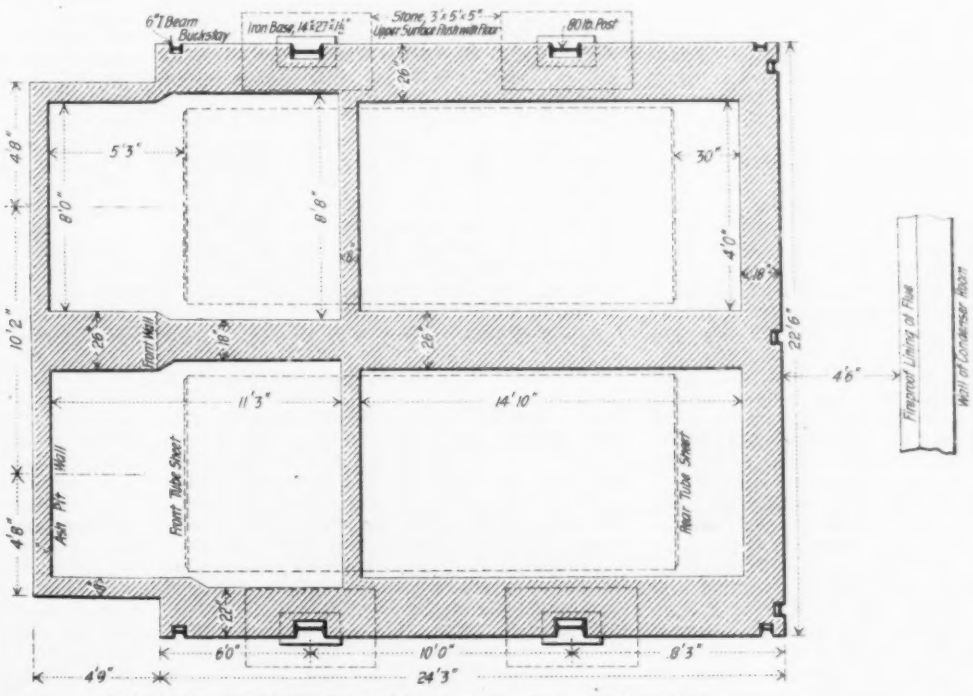




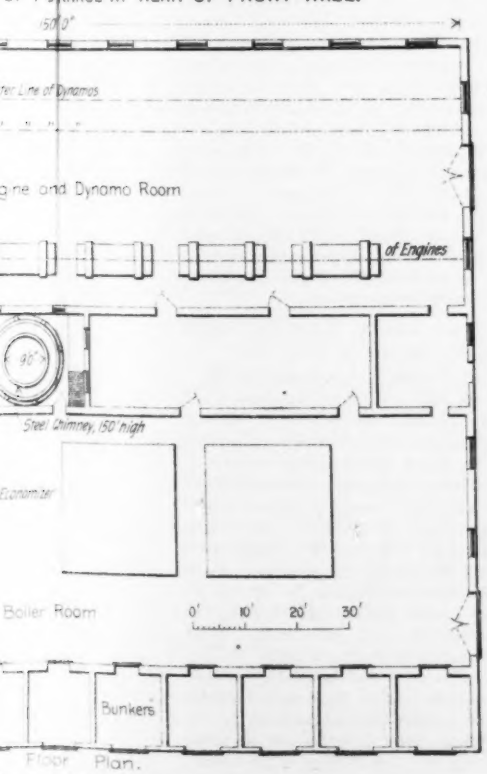
LONGITUDINAL SECTION OF FURNACE, SHOWING BOILER IN ELEVATION.



OF FURNACE AT REAR OF FRONT WALL.



SECTIONAL PLAN OF BRICK WORK JUST ABOVE FLOOR LEVEL.



Floor Plan.

POWER HOUSE.

STEAM BOILERS FOR DETROIT MUNICIPAL ELECTRIC LIGHTING PLANT.

Designed by C. C. Peck, Rochester, N. Y.

Alexander Dow, M. Inst. Elec. E.,

Engineer Detroit Public Lighting Commission.

CHAS. HART & SONS, LITH., 26 VESEY ST., N. Y.

Panama and Nicaragua canals, with returns from some part of all the Central American states except Honduras, and with the observations of the more reliable among travelers, he makes a general statement of rainfall conditions for that section. Taking in the country between Darien and Yucatan, he finds a narrow, irregular land surface, 1,200 miles long by from 30 to 300 miles wide; with a backbone of mountain running through it, generally less than 10,000 ft. high, and for full half the length less than 6,000 ft. above sea-level. As sources of rainfall, we have the Equatorial rain-belt, which accompanies the sun north and south twice a year over this section, and rains at a station when the sun is in the zenith; the northeast trade winds traversing the warm Caribbean Sea; the rains from the north, coming with the winds blowing over the warm Gulf of Mexico, and finally the cyclonic rains which accompany the great atmospheric disturbances occurring at certain seasons in the West Indies.

Omitting detail, we find the greatest annual rainfall in all Central America at Greytown, the Atlantic entrance to the proposed Nicaragua Canal. It there assumes the enormous total of 240 ins., 20 ft., a figure which is only surpassed in the Western Hemisphere on the Mexican Gulf coast in the West Indies, by Guiana and by the coast of Brazil. The next point of greatest precipitation is in British Honduras, and the next on the east coast of Panama. But as far as Greytown is concerned, the observations of the canal engineers show that the wind which produces such an enormous rainfall there is lessened in effect by one-half in ascending 100 ft. above sea level; and at Rivas, on the canal, but west of Lake Nicaragua and 200 ft. above the sea, the annual average is only 60 ins. Mr. Harrington concludes that the rain-bearing stratum of the trade winds is very shallow as it reaches this coast, and that most of its rain is dropped at elevations less than 500 ft. above sea level. He further says that it is safe to say that in Central America from 7 to 10 per cent. of the total annual rainfall may descend in one day, and on the Pacific, with much less rainfall, the daily fall may reach from 10 to 15 per cent. of the annual total. Actual observations made at San Jose, at an elevation of 3,724 ft. above sea-level, show a greatest hourly rainfall of 1.9 ins.; this is at the enormous rate of 46 ins., or nearly 4 ft. in one day, while the annual rainfall is 64 ins.

The results of such a precipitation can be better imagined than described: dry river-beds become torrents in minutes, the water coming down in a wall several feet high; marshes change to lakes, and the power so quickly developed is necessarily very dangerous to any work of man. With such possibilities in view, the importance of flood disposal in connection with the location of a ship-canal can be appreciated, and the wisdom of locating the Greytown end of the Nicaragua Canal as close as possible to the crest of the water-divide in that region is apparent. This is a feature which is seemingly overlooked by the advocates of routes closer to the River San Juan, or on the south bank of that river, where several lateral watersheds of enormous area would have to be dealt with.

THE CHICAGO PLAN OF INTERCHANGE AT THE M. C. B. CONVENTION.

During the past few years there has been a growing sentiment among railway Master Car Builders toward increasing the number of items in car repairs, for which owners should be held responsible. A careful comparative study of the Rules of Interchange for a number of years back will show that nearly every year new items, for the good repair of which car owners were to be held responsible, have been added. The results which have been brought about, however, do not satisfy many of the officials in charge of the car departments, and there has, as many of our readers know, been a strong effort made during the last two years to increase this list of items to include practically all of the expensive parts of the car. The initial effort was made a year ago, at the annual convention of the M. C. B. Association, held at Saratoga, N. Y., and was, as we noted at some length at that time, defeated by a large vote. At the convention held at Alexandria Bay, N. Y., last week, a second and far stronger effort was again defeated, but by only a very small vote, as will be seen from the report of the proceedings, given elsewhere in this issue.

As the increasing strength of the advocates of this measure indicate a fair probability of success in their efforts by another year, and as the proposed changes are a radical departure from the principle upon which the Rules of Interchange were founded and have been operated for years, it seems necessary to consider the question somewhat more in detail than the mere record of proceedings given on another page can do.

To enable a clear and comprehensive understanding of the question, it is necessary to refer briefly to the origin and development of the present well-known Rules of Interchange of cars on American railways. When the railway system of the country had reached a stage of development where through traffic from widely separated parts of the country became an essential feature of transportation, several problems were introduced into the handling of cars which had not before appeared. Few railways were able to convey this through traffic the entire journey on single lines. It became necessary, therefore, to transfer it at the end of their own lines to other lines, which would take it on further toward its final destination. A system of interchange of cars was thus developed, and it became necessary to formulate rules for conducting it. Speaking broadly, these rules provided that each company should receive a certain rental or mileage rate for the use of its cars by other companies, and a compensation, or satisfactory repairs, for damage done to its cars by other companies. To facilitate interchange, it was provided that any foreign road, having damaged a car by the breakage of some part which did not prevent it continuing its journey, should, in passing that car on to another foreign road, give a defect card, stating that such and such damages had been done by its road; otherwise the receiving road might refuse to take the car, in order to protect itself from being charged with the damages by any road to which it might subsequently deliver it. It will be seen that the defect card was practically a voucher authorizing certain repairs to be charged to the road issuing it, by whomever the repairs were made.

The foregoing brief explanation will give a fairly clear general understanding of the method of interchanging railway cars in America. Of course, many modifications and exceptions for particular circumstances were introduced from time to time, as they were thought advisable or necessary by the roads who formed the association of railways agreeing to act by this code of rules. It is almost unnecessary to state that the Master Car Builders' Association, or rather certain members of the Association, are practically the official representatives of the railways in making these changes of the rules, although their action is not decisively binding upon the railways.

Returning now to the action of the convention of the Master Car Builders' Association recently held at Alexandria Bay, it will be seen from the report of the proceedings that certain members propose to change radically the Rules of Interchange so as to make the owners of cars responsible for damages, and not the roads injuring those cars in service, and certain other members advocate holding to the rules as they now stand.

The arguments of the advocates of the change are briefly these: When the rules were first formulated, the interchange of cars had not reached the development of present years. Special classes of freight, like fresh meats, fruits, etc., did not have to be transported across half a continent at almost express train speed, and delays were not of such vital importance as they are now. Moreover, the rules were few in number and simple. Now they are complicated and ambiguous, and cannot be used and do business. As a proof of this, it has been found necessary by nearly all railways to adopt special sets of rules at certain interchange points, or to modify the M. C. B. rules materially. The work of car inspection has assumed enormous proportions, and the issuing of defect cards is a business by itself. In other words, they condemn the present code of rules as thoroughly impracticable with the present necessity for fast freight service.

On the other hand, they claim that by making the owners of cars responsible for defects, the work of inspection will be reduced, interchange will be facilitated, delays to valuable freight avoided, with the consequent saving of money, and but little, if any, greater cost to the companies for repairs than is now the case. In proof of these statements they announced that the proposed new rules of interchange have had practical trial at Chicago and other Western cities for six months, and the results have been satisfactory in all respects, and fully substantiate the claims they make.

The opponents of the proposed new plan of interchange argue that the practical trial of the new rules which has been made at Chicago has not been of sufficient duration to determine fully whether they will work satisfactorily in the long run or not. Furthermore, they argue that the plan is opposed to the principle upon which the M. C. B. rules have been formulated and used, viz., that the user of a rented property shall compensate the owner by the payment of certain sums which are sufficient to cover the interest on the principal invested, taxes, insurance, ordinary wear, and, lastly, the depreciation which, after a lapse of years, renders the original investment valueless. The user of a car pays the owner a certain amount per car-mile, and this amount continuously paid during the normal life of the car reimburses the owner in precisely the same manner as is the case with any other leased property. The present mileage rate has been established upon the knowledge of the cost of repairs to foreign cars under the present rules, and it does not, therefore, seem proper to adopt a measure which may very seriously affect the earnings of cars on foreign roads.

These are briefly the main features of the arguments put forward for and against the proposed new plan of interchange. As has already been stated, the opponents of the plan defeated it at the recent convention by a small margin, the advocates lacking but fifteen of the necessary two-thirds vote to carry it. An analysis of this vote shows, as we foretold would be the case a year ago, that the plan was defeated by the roads in the East which owned large equipments of cars. Roads like the Pennsylvania, New York, Lake Erie & Western, Philadelphia & Reading, and other large car owners, defeated the plan by their heavy car vote, although a viva voce vote would have carried it by a large majority. The character of the vote has its significance.

The large owners of cars feared that their receipts from car mileage would be reduced, and that the smaller roads owning few cars would still further reduce their equipment to the necessities of local traffic, and depend upon their better equipped neighbors for the larger part of their cars. Coupled with these reasons there were possibly others of less moment. Railways like the Pennsylvania and New York, Lake Erie & Western taking through freight at Chicago and delivering it over their own lines at the Atlantic seaboard, feel less need for more rapid interchange of cars than do the roads which deliver their cars to foreign lines at Buffalo, Pittsburg and other cities halfway between the receiving and distributing points of their freight. Whether these reasons are weighty enough to overbalance the advantages claimed for the proposed new plan of interchange, is another question; the fact remains that they defeated it.

At the same time it seems pretty certain that the new plan of interchange will become adopted by a large number, perhaps the majority, of railways, if it continues to show as good results everywhere as it has thus far shown at Chicago, Cincinnati and other large interchange points. It is possible that a longer trial may develop objectionable features that will more than counterbalance the good features, but the trial already had, lasting over six months, is pretty good evidence against the probability of it doing this. The plain facts of the matter are that sooner or later some change has got to be made in the present rules of interchange if they are to remain the force in regulating the interchange of cars in the future that they have in the past. When conservative and level-headed motive power officials get up and condemn the rules as thoroughly impracticable and habitually disregarded, it needs no very long argument to show that some change is necessary. The needed change may be

the Chicago plan of interchange, or it may be some other plan, but some new plan must be adopted. Fast freight service is an established factor in modern railway transportation in America, and any rule or code of rules tending to prevent it will certainly be put aside in its favor.

The Chicago plan of interchange has for its prime object the facilitation of interchange by making car owners responsible for defects. By it when a car reaches an interchange point it is accepted with an inspection for safety only, for the receiving road knows that it will not be liable for the cost of defects, and passes it on its journey without any delay for a defect card. In the present rules the protection of the car owner is placed first and the facilitation of interchange second, while in the proposed Chicago plan these conditions are reversed, with the further claim that the interests of car owners will not be endangered seriously by the change. What basis the advocates of the Chicago plan have for this last claim is pretty clearly indicated in the discussion published in another column.

On the other hand, those who advocate holding to the present rules claim that with a common-sense interpretation, interchange is as rapid as the requirements of traffic demand. In this connection, it may be observed that nearly all railways have special codes of rules with their different connections. They have evidently found these necessary to facilitate interchange, or else they would not have them. Take, for example, the lines of the Pennsylvania Co. and the Pennsylvania R. R. Co., and the Vanderbilt lines east and west of Buffalo, which have separate operating departments, and to a certain extent separate managements, although controlled by the same interests: it was brought out in the discussion that the interchange of cars between the different systems was conducted on practically the Chicago plan—that is, inspection for safety only. In other words, the Pennsylvania system west of Pittsburg and the Pennsylvania system east of Pittsburg have found it to the best interests of the joint owners of both systems to radically change the present rules of interchange, and the advocates of the Chicago plan argue with some reason that if this is necessary with closely affiliated lines, it is also necessary with interchanging roads owned by separate companies. Too much stress must not be laid on this argument for obvious reasons, but it points to the fact that the present rules of interchange are not all that is desirable, even to their advocates.

To sum up briefly, it is generally admitted that increased facilities of interchange are demanded, and that the present rules do not supply these facilities. The Chicago plan, as far as present experience goes, does supply them in a great measure, and does it without any inordinate increase of expense to car owners. At the same time it introduces dangers to the interests of large car owners, and should be, its opponents say, accepted with great caution. In fact, like any other plan deviating widely from long-used principles, the Chicago plan has got to prove its superiority by practical results extending over a more or less long period of time. We are inclined to believe that fully as much progress in facilitating interchange will be made in the long run by holding the adoption of the plan over a year as if it had been adopted this year against the protest of powerful railways.

It is practically certain that the advocates of the Chicago plan will push it next year, unless something unforeseen occurs. It was defeated this year, but its advocates made a masterly retreat, and their opponents were compelled to accept a bare victory, although they made a vigorous attempt to secure the adoption of a modified code of rules of their own devising. Meanwhile the roads now using the Chicago plan will continue with it, and will use their best endeavors to extend its use among other roads.

LETTERS TO THE EDITOR.

DETERMINING THE MOST ECONOMICAL CEMENT.

Sir: In your paper of May 30 is a criticism by Mr. Fred P. Spalding, of Ithaca, N. Y., on my suggested method of determining the most economical cement among any number tested, in which he says: "The difficulty in applying such a method lies in the fact that it assumes the actual value of the material to be shown by tensile tests of mortar only a few days old."

This assumption by Mr. Spalding as to the time of application of the proposed method is entirely due, no doubt, to the fact that the example given by me of its application showed that the computations were made from seven-day tests. The example was to show the method of computation, not to indicate short tests. I am well aware of the unreliability of short tests, but I proposed to show that from results of sufficient tests of a number of sand mixtures from cements, all of which have stood the tests for soundness and setting qualities, the comparative values of the cements can be obtained by properly combining their relative strength with sand and cheapness.

The relative "strengths" may be measured by the relative capacity of sand mixtures to resist abrasion, or compression, or tension, depending upon the uses to which the mortar is to be applied. I had no idea of restricting tests to short times or to omit any of the usual tests for soundness—time was by no means one of the elements considered in my communication printed in your issue of May 16, but the interpretation of results, as far as relates to economy in practical sand mixtures and concrete, was in question.

Very respectfully, W. L. Marshall,
Major, Corps of Engineers.

2258 Wabash Ave., Chicago, June 4, 1895.

LAYING OUT STREET RAILWAY GRADES ON A WARPED STREET SURFACE.

Sir: In most of the streets of our older cities and towns, the grades are much broken, and the cross-section is constantly changing, first one curb being the higher and then in a hundred feet or so the other. This entails considerable expense for paving, should the grade of the new tracks not fit the old street surface.

By the following method the new grade may be easily and certainly fitted to the street, and the comparative elevations of track, gutter, and curb may be seen at a glance: After the alinement has been settled, a profile run, and cross-sections taken over the proposed line, plot the profile of the center line on ordinary profile paper to a large scale, and through each cross-section station on the profile line, at any constant angle, say, 45° with the vertical, draw lines, and call them "level-lines." On these, to any desired scale, lay off the distances to the points where cross-section elevations were obtained on the street; usually at the outer rail, the gutter, and curb. Through each of these points draw vertical lines and on these lines, to the same scale as the vertical scale of the profile, plot the elevations as so much above or below the "level-line" as they are above or below the center station. Connect these points and it gives the cross-sections and profile combined. From this may be obtained the profiles of the outer rails, referred to the center elevation, as so much above or below the "level-lines."

It is frequently of use to know how much above or below the rails the curb or gutter may be, and this, or any other data, both on regular grades or vertical curves, is easily obtained by inspection of the map. W. C. H.

Washington, June 5, 1895.

THE VALUE OF STATE TOPOGRAPHICAL SURVEYS.

Sir: I have been especially interested in the extract from Mr. R. A. Cairns' address at Rensselaer Polytechnic Institute, in your issue of May 9, in which he pays tribute to the great value of state topographical surveys to engineers and others engaged in developing enterprises involving a study of topography. The special survey to which he refers is that of Connecticut—made by the U. S. Geological Survey operating in connection with the state authorities.

I happen to know by personal experience something of the character of the work done in Connecticut.

While conducting until recently the summer school of surveying of Columbia College, located at Bantam Lake, I had topographical sketches made by students of a very considerable area along the valley of the Naugatuck down to Waterbury, and also in the vicinity of Litchfield. This gave me frequent opportunities of checking the work done by the U. S. Geological Survey parties, and in very few instances were discrepancies of any importance to be found. It is true that it is possible for a student to get access to the state maps and correct his work to agree with them, but it is equally possible for an instructor to know if such a thing is done.

It is strange, indeed, that New York still refuses to complete a work of so great importance to its people, when several of the New England states and New Jersey have demonstrated beyond a shadow of a doubt the practical utility and comparative cheapness of a good topographical survey. James L. Greenleaf.

1 Broadway, New York city, May 11, 1895.

STANDARD CONNECTIONS FOR ROLLED BEAMS.

Sir: In the very interesting article on "Standard Connections for Rolled Beams," by Mr. H. S. Prichard, published in your issue of May 16, on p. 319, the author says:

Let d_1, d_2, d_3, etc., equal the distances of the forces y_1, y_2, y_3, etc., from the center of rotation. The forces y_1, y_2, y_3, etc., will be to each other as their lever arms, d_1, d_2, d_3, etc. . . . .

Recognizing that there must be a law governing the relation of these forces, y_1, y_2, y_3, etc., I cannot find a mathematical proof that it is governed by the law given above, and would be very much obliged to have the proof given by the author of above article.

Respectfully, W. F.

(We referred the above letter to Mr. Prichard, and append his reply as follows:—Ed.)

Sir: In reply to the question by W. F., I would say that under the action of the vertical forces the connection angles will rotate until the forces, y_1, y_2, y_3, etc., are developed. The amounts of these forces, y_1, y_2, y_3, etc., will from the laws of flexure be directly proportional to the deformations of the bolts. These deformations are caused by and are proportional to the changes in position of the surfaces of the connection angles, which bear on the bolts with regard to the surfaces of the beam which bear on the opposite sides of the bolts. As the changes in position are caused by the rotation and deformation of the connection angles, they will, if the slight deformation of the angles is neglected, be proportional to the distances of the bolts from the center of rotation. It follows, therefore, that the forces y_1, y_2, y_3, etc., will be proportional to the distances of the bolts from the center of rotation. The deformation of the connection angles, which is neglected, is small; to take it into consideration would further complicate calculations already intricate, while to neglect it is to err slightly on the side of safety.

The problem in theoretical mechanics which the determination of the strains in the bolts of a beam connection presents is an interesting one. But it was for the practical purpose of having tables prepared which could be used with safety, and which would be a substitute for the very erroneous method in general use, rather than from scientific interest, that the subject was investigated. The tables have been in constant use for about two years. Very truly yours,

H. S. Prichard.

Trenton, N. J., June 13, 1895.

CONCERNING NICARAGUA CANAL ROUTES.

Sir: Your issue of May 2 has just come to hand, and I have read with great interest your article on the Nicaragua Canal location. I do not think that at present any one who really knows anything of Nicaragua would ever propose seriously the expenditure of any money in the hope of finding any route between the lake and the Atlantic north of the present location, to the demonstration of which absurdity your article principally confines itself, while it dismisses with a few words the tortuous course of the San Juan itself. Now, this question is one on which depend millions of money, as well as the credit of American engineers, to avoid disaster even more crushing than has already occurred at Panama. It is therefore much to be desired that the opinions of all interested should be given and received with careful consideration and freedom from all personal prejudice and rancor, whether they happen to be for or against our preconceived notions. It is purely in this spirit that I make the following remarks, and I do not propose to inflict upon you or your readers a lengthy discussion of the points of the location. Your valuable paper is not just now the best place for such a discussion in detail; the commissions of competent engineers already appointed can, and no doubt will, obtain all the information they need, and if they wish my little share of it they are welcome to have it at any time.

I only wish to ask you if it has never struck you as a very curious fact in examining the plans of the Nicaragua Canal Construction Co. that the San Juan River, so important an item in any possible canal location through Nicaragua, has only been really surveyed on its north bank? The south bank has been merely filled in with "fancy work" on the plans hitherto exhibited to the public, and remains, for all engineering purposes, an absolute blank on that side from the ridge line of the San Carlos River to the Atlantic. The reason for this state of things is simple. There was great difficulty in obtaining the concession from Nicaragua, and great difficulty, law expenses and a final arbitration by President Cleveland as to the boundary between Costa Rica and Nicaragua. The San Juan River being the boundary for a considerable portion of its length, Costa Rica claimed, and has always been determined, to have equal rights in the construction of any canal. Nicaragua disputes this, and it was understood when the concession was granted that if it was possible the canal should be built wholly on the Nicaraguan or north side of the river.

The canal company had a great deal of trouble over the concession that they had to secure from Costa Rica for the indispensable portion of the work that would touch her territory as far down as the San Carlos River. Permission was given under this concession for all necessary surveys on Costa Rica territory and for the construction of dams, etc., an end of which would have to tie into her soil.

Surveys proper on Costa Rican territory were never made, and the very partial work done by Mr. Menocal and others in short excursions on that side of the river, I claim to be wholly useless in determining the location, when you compare it with the minute and careful work done on the other side. I, and also many others who have been on the ground and made such excursions, believe that a much better line exists by using more of the San Juan River to advantage and keeping perhaps on the Costa Rican side of the river down to the mouth of the Colorado River, even if it should locate the Atlantic terminus of the canal on Costa Rican territory.

There could hardly be a worse terminus anywhere than Greytown harbor, and the work done there by the Canal Company has gone far to prove this by its utter failure to accomplish anything. The money spent there I would never consider wasted if it only proved that much, but am I wrong in thinking that now is the time for an impartial survey, and after it has been made then deal with the political side of the matter. Even if I am quite wrong in the belief I have on this point, think of the structures proposed on the present location; dams 1,300 ft. long on the crest across such a river as the San Juan to be built of loose rock, making its own foundations and keeping its own crest, even without aid of any kind; an apron of loose rock with a sheet of water perhaps 3 ft. thick and 1,000 ft. wide running over it without damage, and not one of these, but many of similar proportions. "The great divide cut" will cost, on Mr. Menocal's own estimates, nearly 25% of the total, for it is 2½ miles long, 320 ft. deep in the middle, with a curved alinement and a prism section only 80 ft. wide and 28 ft. deep for our great ocean steamers to plunge through, "like a piston going through a cylinder." Could they go at all? And if so, could they go safely?

Is it not worth while trying to avoid such features and face whatever political complications may arise? And if we must eventually undertake such stupendous structures let us adopt no untried and grossly underestimated methods of construction to overcome them. Say what the canal really will cost and not try to make people believe that $65,000,000 is a full estimate covering all contingencies. I am, yours very truly,

J. T. Ford, Assoc. M. Inst. C. E.

C. M. R. R., Cartagena, Rep. of Colombia, S. A., May 24, 1895.

(With our correspondent, we do regard as absurd any attempt to seek a more northerly route for the canal, and we argued against it simply because some engineers held that belief. But notwithstanding what Mr. Ford says about lack of surveys, and leaving political entanglements out of the question, we do not believe that a route south of the San Juan is any more available as a location for a ship canal in the tropics. As before explained, the disposal of the floods in tributaries of the San Juan is a most important—indeed a ruling—consideration in fixing upon any line, with the rainfall of the immediate neighborhood of the eastern end of the canal to be disposed of. The present location, on the north bank of the San Juan, takes advantage of the fact that the crest of the river's watershed on that side lies very close to the river, and thus the watershed is comparatively limited in extent. With the canal carried parallel with this crest-line, and as close to it as the topography will admit, the danger from floods is reduced to a minimum. On the south bank of the San Juan, on the other hand, three great rivers would have to be dealt with on the eastern half of the canal—The San Carlos, the Sarapiqui and the Colorado. These rivers rise in the very heart of Costa Rica, on the Atlantic slope of the mountains, and have enormous watersheds, and a correspondingly enormous flood capacity. What our correspondent would do with them, he does not explain; but we do know that the disposal of the Chagres floods was to the end a problem unsolved by the Panama engineers.

As to the aggregation of "loose rock" for the Ochoa dam, objected to by Mr. Ford, we honestly believe it to be the safest way to solve a troublesome engineering problem. This dam is located just below the mouth of the San Carlos River, not from choice, but from necessity; as to get above it would necessitate very deep cutting through bold, rocky promontories. But, though this river does empty into the canal, it is so close to the dam that the topography on that side admits of the cutting of a waste-weir through rock, remote from the proposed dam, and emptying far below it. As we understand the conditions, the foundation material at Ochoa is very unsafe for a masonry dam, even were proper stone and the necessary skilled labor available. But "loose rock" is very abundant, and as such a dam would find its own bottom and slope during construction, and would slowly silt up, it seems the much safer construction. It would depend upon weight and mass for its safety, and not upon the niceties of proper and sufficient foundation, careful workmanship and due proportions, conditions practically impossible of fulfillment there.

The San Carlos waste-weir would dispose of so much of the flood water that we do not apprehend the heavy flow over the Ochoa dam suggested by Mr. Ford. And there is no good reason why the crest of this dam should not be protected.

The "divide cut" on the existing location is a formidable piece of work, but it seems to be even more formidable than Mr. Ford makes it. For, instead of a prism 80 ft. wide and 28 ft. deep, as stated by him, the latest published plans of the Nicaragua Canal show a least bottom width in the canal and at the "Divide" of 100 ft. and a least depth of 30 ft. This latter is small enough, we will admit, but this is one of the questions which the Board of Expert Engineers, now in Nicaragua, will have to report upon in revising Mr. Menocal's plans and estimates. With our correspondent, we believe that the public interest lies in the fullest examination into the difficulties to be overcome, and a thoroughly honest and liberal estimate of cost under the most unfavorable conditions. But we know enough of prevailing conditions, without further surveys, to make us regard as highly improbable any improved location south of the San Juan River.—Ed.)

IRON AND STEEL INDUSTRIES IN 1894.

The American Iron and Steel Association has issued its annual statistical report covering the condition of the iron and steel interests in the United States and abroad for the year 1894.

Commencing with a general review of the domestic iron trade, the report concludes that no considerable advance should be looked for the present prices of iron and steel, in the near future at least; but there will be some advance and a steadiness in prevailing prices. The new tariff effectually bars the way to any considerable rise in price, and it is now realized that this same tariff will certainly increase our imports of many manufactured products, despite our low prices. The Assocation generally condemns the present tariff laws, and declares that the existing industrial conditions in this country are abnormal, as neither capital nor labor is now sufficiently rewarded.

The general statistical summary for the United States for 1894 may be tabulated for greater convenience, and compared with 1893 as follows:

	1894.	1893.
Iron ore mined, gross tons	11,879,679	11,587,629
" " shipped from Lake Superior mines	7,748,932	6,000,492
Iron ore imported	167,307	526,951
Connellsville coke, net tons	5,454,451	5,054,797
Aver. price of Connellsville coke	$1.00	$1.59
Pocahontas Flat Top coke	895,684	514,722
Penn. anthracite coal, gross tons	41,391,200	43,089,537
Cumberland coal, gross tons	3,966,106	4,347,807
Pig iron, gross tons	6,657,388	7,124,502
" " 1st half of 1894	2,717,983	.....
" " 2d " " "	3,939,405	.....
" " Bessemer quality	3,808,567	.....
Bessemer steel ingots, gross tons	3,571,313	3,215,686
Open-hearth " " " "	784,936	737,800
Rails of all kinds, gross tons	1,021,772	1,136,458
Miles of new railway	2,000	2,828
Locomotives built by 13 comp's	695	2,011
Freight cars built	17,029	51,216
Passenger cars built	510	1,980
Structural iron and steel shapes, not including plate girders	505,901	387,307
Wire rods, gross tons	673,402	537,272
Wire nails, kegs of 100 lbs	5,681,801	5,095,945
Cut nails and spikes, 100-lb. kegs	2,425,000	3,048,933
Foreign value of all imported iron and steel products	$20,843,576	$29,656,539
Foreign value of same in 1887	$56,420,607	
Tin plate imports, gross tons	215,068	253,155
" " " in 1889, max	331,311	.....
Exports of iron and steel, excepting agricult. implements	$29,943,729	$30,159,363
Immigrants, number	250,313	495,030

The report gives the average prices of iron and steel per month and by the year; but for general purposes the annual average price is sufficient to show the marked shrinkage that has taken place in values. This table is as follows for tons of 2,240 lbs., and per 100 lbs. for bar-iron:

	1891.	1892.	1893.	1894.
	$	$	$	$
Old iron T-rails, at Philadelphia	22.05	19.48	16.43	11.95
No. 1 anthracite f'dry pig, Phila.	17.52	15.75	14.52	12.66
Gray forge pig, Philadelphia	14.52	13.54	12.73	10.73
" " lake ore, Pittsburg	14.06	12.81	11.77	9.75
Bessemer pig iron, Pittsburg	15.95	14.37	12.87	11.38
Steel rails, at Pittsburg mills	29.92	30.00	28.12	24.00
Steel billets " " "	25.32	23.63	20.44	16.58
Best refined bar, Philadelphia	1.90	1.87	1.70	1.34
" " " Pittsburg	1.71	1.64	1.50	1.20
Wire nails, Chi., per keg, f. o. b.	2.04	1.70	1.49	1.11

The wholesale price per box of "full weight," 108 lbs., coke Bessemer tin plates, I. C., 14 × 20 ins., freight and duty paid, was as follows: January, 1890, $4.72; January, 1891, $5.35; January, 1892, $5.30; January, 1893, $5.35; January, 1894, $5.27, and March, 1895, $3.80. The average yearly circular price of hard, white ash anthracite coal at Philadelphia, per gross ton, f. o. b., was as follows for the classes named:

	Lump.	Broken.	Egg.	Stove.	Chestnut.
1889	$4.04	$3.78	$3.95	$4.12	$3.92
1890	3.92	3.74	3.92	4.05	3.73
1891	3.85	3.68	3.84	3.93	3.61
1892	3.97	3.72	3.98	4.16	4.00
1893	3.90	3.77	3.97	4.24	4.23
1894	3.90	3.83	3.97	4.18	4.18

The three periods of particularly low prices for iron and steel in this country, since the close of the civil war, were in 1873, 1884-85 and in 1891-95. The following table shows the lowest quoted prices in these periods for the six leading products mentioned, in tons of 2,240 lbs., and per 100 lbs. for bar iron:

	1873-79.	1884-85.	1891-95.
No. 1 anthra. f'dry pig, Phila.	$16.50	$17.50	$12.00
Gray forge pig, Lake ore, Ptts.	16.00	14.00	8.90
Old iron T-rails, Philadelph'a	18.00	16.50	11.00
Best bar iron, Pittsburg	1.60	1.50	1.10
Steel rails, mills, Pa.	40.00	26.00	22.00
Bessemer pig, Pittsburg	19.50	17.00	9.95

Prices for Lake Superior iron ores per gross ton delivered at lower ports on Lake Erie, are quoted for each mine from 1890 to 1895, inclusive. In this period the price has fallen from $6.50 to $3.50 per ton for the Republic and Champion No. 1 mines, and from $4.50 to $2 for non-Bessemer soft hematites. The Mesabi No. 1 Bessemer is now delivered at Lake Erie ports for $2.50 per ton, and the non-Bessemer for $1.75 per ton.

Our exports of iron and steel, not including agricultural implements, chiefly embrace machinery, builders' hardware, sewing machines, saws and tools, locomotives, firearms, scales and balances, pig iron, steel rails, wire, miscellaneous castings and engines and boilers. The total value of these exports was $14,185,359 in 1871, and with two slight declines below that figure, in 1873 and 1876, reached a maximum of $30,736,507 in 1891. The value in 1894 was $29,943,729. In valuation, in 1894, machinery came first, with $10,715,520; builders' hardware, saws and tools and sawing machines represented respectively $2,452,732, $2,019,199 and $2,064,787.

The number of furnaces in blast at the close of 1894 was only 185, the smallest of any year since 1874, except at the close of 1893, when only 137 were in blast. But on June 30, 1894, only 108 were in blast and 408 were out of blast.

The pig iron production of Great Britain for 1894 once more surpassed that of the United States by 707,357 tons; the product being reported by the British Iron Trade Association as amounting to 7,364,745 tons. The maximum pig iron output of Great Britain was 8,586,680 tons, in 1882, nearly equaled by the products of 1883 and 1889. In 1890 the United States made 9,202,703 tons of pig-iron, as compared with 7,904,214 tons for Great Britain for the same year and remained ahead, with 1890 as a maximum, until last year. England reached the million mark in tons of pig iron produced in 1836; the United States only reached the same mark in 1864. Germany's production reached one million tons in 1866, and in 1894 she produced 5,416,000 metric tons of pig iron and 3,621,000 metric tons of finished steel of all kinds. France, in 1862, made 1,090,837 metric tons of pig iron, and 2,077,647 tons in 1894. Belgium, Sweden, Austria and Russia are comparatively small producers, the product of neither country reaching one million tons in 1894, though Russia and Austria approach that figure closely.

THE CARSON-TRAINOR TRENCH MACHINE.

In the excavation of trenches for sewers, etc., in city streets, where it is essential to keep the excavation as narrow as possible, and to avoid interference with traffic by the handling of the excavated material, the use of trench machines, or overhead conveyors, has in recent years become very general. The Carson Trench Machine Co., of Boston, Mass., was a pioneer in the introduction of machinery of this class, and it has from time to time time improved its machines to keep pace with the demands of contractors and engineers.

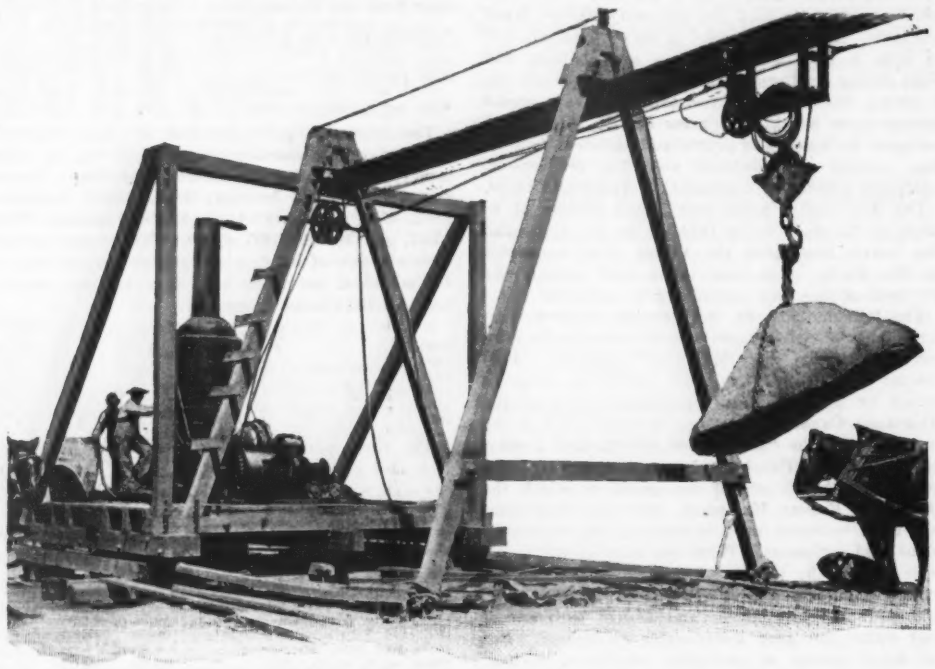


FIG. 1. CARSON-TRAINOR CONVEYOR EXCAVATING A TRENCH 28 FT. WIDE AND 30 FT. DEEP IN BOSTON.

As most of our readers are aware, the principle of all trench machines is to hoist the buckets of excavated material, convey them back and dump them over the completed arch or sewer as backfilling, or into carts if the material is to be hauled away, thus avoiding all piling of dirt in the street and rehandling of material. In the first machine brought out by the Carson Co. the excavated material is carried by a row of small buckets suspended from trolleys which run on a track attached to the overhead trestle, which extends along that part of the trench where work is in progress. This machine does excellent work in small trenches; but for large and deep trenches there are many advantages in substituting a single large bucket for the several small ones. In soil containing boulders, or where blasting has to be done, it is especially advantageous to be able to put a sling around large stones and hoist them in place of the bucket. To meet these demands, the Carson Co. some time ago brought out the Carson-Lidgerwood trench machine, in which the trolley carrying the buckets travels on a wire cable, the operation being similar, in fact, to the well-known Lidgerwood cableway.

A number of these machines have been built and are doing good service, but the time required to move the machine ahead as the work advances, on account of the necessity of strongly anchoring the cable, has led to the introduction of an improved machine in which the bucket travels backs and forth on a fixed track, as in the first Carson machines built.

This machine, known as the Carson-Trainor trench machine, is illustrated in the accompanying engravings.

The supporting trestles are wooden A-frames, 18 ft. span and 20 ft. high, placed 16 ft. or 32 ft. apart, the feet resting on the sides of the trench, or, if the trench is more than 15 ft. wide, upon transverse timbers spanning the trench. These frames are of spruce sticks, 6 × 8 ins., with oak headers 4 × 8 ins. The feet are connected by longitudinal horizontal spruce braces, 4 × 4 ins., and are fitted with small double-flanged castor wheels. The entire working section of 288 ft. of trestle is moved ahead from time to time, as that work progresses. The wheels run on rails laid upon the cross timbers, as in Fig. 1, or laid on stringers at the sides of narrow trenches. The view in Fig. 1 shows the machine at work on a sewer trench 28 ft. wide and 30 ft. deep in the Roxbury district of Boston. In this machine the frames are placed only 16 ft. apart, but they are usually placed 32 ft. apart.

Along the tops of the A-frames is the trackway, composed of two 12-in. channel irons, weighing 20 lbs. per ft., riveted together back to back, forming an I-beam section, and upon the lower flange of this beam runs the traveler, or trolley, which carries the buckets. The track girders are suspended from the heads of the trestles, and are clamped together by the Mills adjustable angle-iron hangers, which give a bottom bearing, and thus prevent an uneven track and keep the girders from twisting. The traveler is of 4 × ¾-in. iron bars, runs on four 12-in. single-flanged wheels, and is fitted with a 16-in. hoisting wheel. The fall block is of sheet steel, fitted with a 16-in. sheave, loose swivel hook and safety handle. There are five tubs or buckets of 1 cu. yd. capacity. These buckets are of flange steel, with double bottoms, and are so balanced that they are top-heavy when full, and bottom-heavy when empty, thus making them self-dumping and self-righting. The automatic catches are on the outside of the bucket. At the head of the excavation are a hoisting engine and boiler mounted on a strongly built car and covered in.

The engine is a double-cylinder Lidgerwood hoisting engine, with vertical boiler. The cylinders are 8¼ × 10 ins., with cranks set at 90°, and the valves are operated by a reversible link motion. The drums are of the Beekman patent friction type.

There are two winding drums on the engine. Around the upper one pass seven wraps of the rope which moves the trolley back and forth on the trestle, and the ends of the rope are secured to the trolley framework. The lower drum winds in or pays out the fall-rope by which the fall-block that carries the bucket is suspended from the trolley. This drum is of the same diameter as the other drum, and is geared to revolve at uniform speed with it. Thus, when the car is run back and forth on the trestle the two drums run together. To hoist or lower the load, the traversing drum is stopped, and the hoist rope is wound in or paid out.

The hoisting drum has a self acting band brake, by which the load can be held at any desired point. The reversing lever, friction and brake levers are all close together, so that the operator has perfect control over the whole machine, and can work both drums or either one of them, as required. The boiler is 42 ins. diameter, and 7 ft. 6 ins. high, with 80 tubes 2 ins. diameter. The engine house has a platform 19 × 16 ft., with a frame built up of eight transverse timbers 6 × 10 ins., and four longitudinal timbers, all of spruce. This is mounted on four 15-in. double-flanged wheels, with steel pins and cast bearings. The head trestle is built upon the rear end of this platform, being securely braced and fitted with the necessary sheaves, etc. Fig. 2 shows the engine, head frame and traveler, and shows also how large stones, etc., are handled. Fig. 3 shows the rear end and tail sheave, with a bucket suspended from

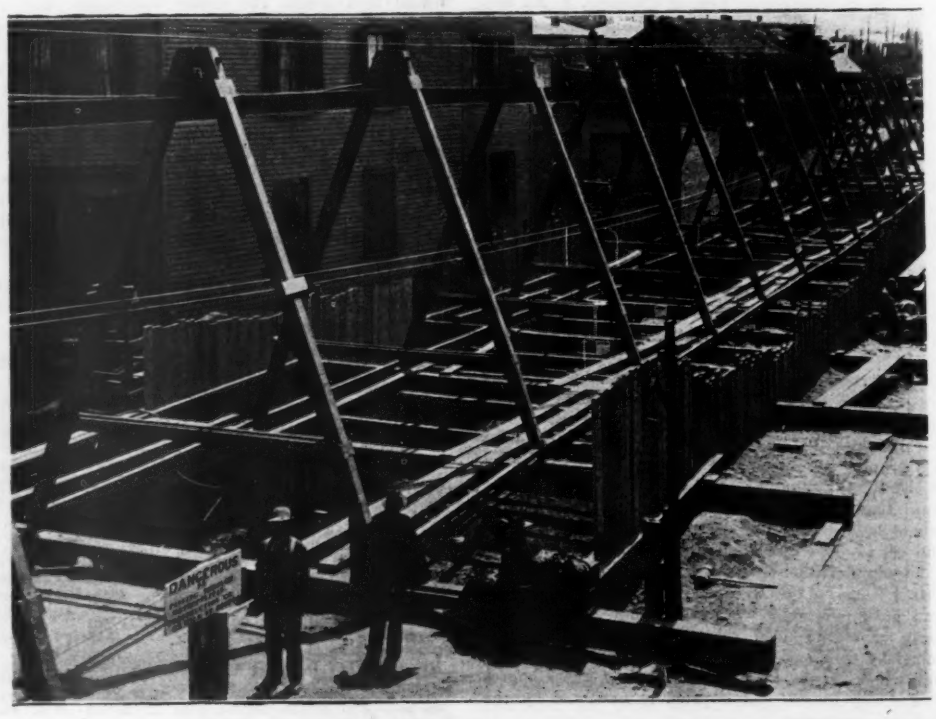


FIG. 2. HEAD END OF CARSON-TRAINOR CONVEYOR, SHOWING TRAVELER.

the traveler. The hoisting and traversing ropes are of crucible steel, ⅝ in. diameter, and the latter is of sufficient length to allow of hoisting from any point of a trench 35 ft. deep. The machine is moved ahead by means of a stout manila rope, the trestles running on 30-lb. T-rails. This machine has a hoisting capacity of 8,000 lbs., and can hoist this load at a speed of 225 ft. per minute, and convey it at a speed of 600 ft. per minute. It can be made with a single traveler, hoisting one tub at a time, or a double traveler, hoisting two tubs, as desired. It is stated that ordinarily the machines make from 30 to 40 trips per hour, but often do much less owing to local conditions, etc., though they can do much more, if necessary. The output is from 300 to 600, or even 800 cu. yds. per day, according to the size of bucket used and other conditions.

The machine is extremely simple in construction and operation. Only four men are required to operate it—an engineman, a fireman, a man at the dump and another at the trench, to give the signals for hoisting and traversing. The material can be dumped into carts for removal or used as back-

Fig. 3. View of Rear End of Carson-Trainor Conveyor.

filling. At street intersections traffic can pass through one of the spans of the machine. One of these machines was put in operation early in May by the Metropolitan Construction Co., of Boston, on the excavation of the Stony Brook conduit, and it was found to be very economical in handling earth. The buckets were of 30 cu. ft. capacity, and the machine easily made 35 to 40 trips per hour, hoisting 20 ft. and running back at least 100 ft. to the dump. Mr. G. W. Judd, Superintendent of the Metropolitan Construction Co., stated that in working the trench in Roxbury (Boston), which is shown in Fig. 1, the average was 30 trips per hour, the machine not being kept fully occupied. This trench is through gravel and rather hard, gravelly clay, which requires six men to each bucket, and the material is dumped into carts, which takes about half a minute longer than if it were dumped as back-filling upon the arch of the sewer. The hoisting speed here is limited from the fact that the bucket has to pass up between braces 8 ft. apart.

The development in trench-excavating machinery from the laborious hand process of shoveling the material from stage to stage in deep trenches has been remarkably rapid. It is claimed that the next step will be to replace the army of men handling picks and shovels which are now required to fill the buckets of a modern trench machine, by excavating machinery. We understand that the Carson Co. has already secured control of a system, in which the material at the bottom of the trench is broken up by plowing, and is excavated by scoop buckets or scrapers on an endless belt, which carry their load to the end of the trench and dump it automatically. Experiments are being made to test the practical feasibility of this system, and if successful, it will be possible to make still further reductions in the cost of sewer work.

HOLLOW TILE FLOORS.*

By Fr. von Emperger.

Hollow tile flooring may be classed in two systems. The first seems to be of European origin, and is said to be the older one, although it has appeared only recently on the French and English market. It consists of single lengths of tube laid from one beam to another. In a late German design the tube is divided by vertical joints, and is provided with iron rods in the lower part to supply the necessary tensile strength. The second system is an American design, the original form probably being that patented in 1871 by Messrs. Johnson and Kreischer. This was also a single tube, but instead of being laid lengthwise from beam to beam, it was placed parallel with them. In the form patented by Mr. Drake in 1873 there are a number of tubes arranged lengthwise and divided into blocks in the usual manner. In more recent systems of flooring manufacturers have partly returned to the use of cross tubes, but divide them into blocks by an arrangement of arch-like joints, and place no reliance on the tensile strength of the lower part of the material.

The author classifies the various floors under three heads. First.—Through construction, consisting of cross tubes, the strength of which depends mainly on continuous vertical ribs. This is more economical than a solid flat arch, but between the arch and the ceiling, where the material is useless, a saving is neither intended nor possible, on account of the method of manufacture. Second.—The old style of construction with curved ribs. This arrangement is represented by a number of the older designs, and carries out fully the engineering idea of a bearing arch with a suspended ceiling. Third.—The old style of construction with horizontal ribs. This is the common type of flooring, and its development was guided apparently by a desire to secure convenience in manufacture, as well as by the belief that with curved ribs it was not easy to change the span. The only trace left of the original idea in these flat arches is a skewback design with inclined ribs; otherwise they do not fall under the head of true arches.

A study of these various methods of manufacturing floors, and of the tests which have been made of them, led the author to the opinion that their strength was largely due to the tensile strength of the joints. To prove that a better floor can be made with the same amount of material by the second than by the first or third system of construction above mentioned, the author had a number of tests made under the superintendence of George Hill, M. Am. Soc. C. E., which established the truth of this view. The author, therefore, advises returning to the use of flooring with curved ribs, and suggests a modification of the building laws by which the construction of a floor will be made to depend upon the load coming upon it.

ANNUAL CONVENTION OF THE AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.

The convention was opened at Alexandria Bay, N. Y., President Wm. Garstang presiding. After the usual prayer, the President read his opening address. Mr. Garstang called attention to the great business depression of the last two years, and congratulated the Association on the brighter prospects of the present year. He called attention to the strike inaugurated in 1894 by the American Railway Union, and the lessons it taught. It appeared that there was a lack of sympathy between the railways and their employees when, without grievance of the railway employees proper, a strike of this character could be inaugurated without warning. Efforts should be made to secure better relations between the railways and their employees. Among other plans which had been suggested was a system of profit-sharing and pensioning old employees. This plan had proved successful in certain manufacturing establishments, but whether it could be made equally successful by railways only experience could prove. Another question which railway officials should consider carefully was that of discipline.

The speed of through passenger trains was being increased every day, and this was necessitating the design of new locomotives. In the designing and constructing of high-speed locomotives, the most desirable features were: (1) Large boiler capacity, with proportionate areas of heating and grate surfaces; (2) large driving wheels; (3) light reciprocating parts; and (4) large bearing surfaces of journals. As the limit of speed and power depends on the capacity of the boiler to furnish steam, it seemed of vital importance that the heating surface be as large as the weight will allow, and the grate surface of sufficient area to permit of fairly slow, and consequently economical, combustion. The type of boiler best adapted to meet the requirements mentioned seemed to be the "radial stay wagon top," because of its large water capacity and steam room, and its lighter weight for a given amount of heating and grate surface as compared with other types of boilers. The use of steel instead of cast iron for large driving wheels decreased the weight of the drivers and enabled additional weight to be put into a larger boiler, thereby getting a boiler of increased capacity without increasing the load on the truck. With a large wheel for passenger locomotives the piston speed was moderate, and there was a better distribution of steam and less wear on frictional parts than could be secured with smaller wheels. The year past had seen the advent of a number of fast passenger locomotives of the eight-wheel type, with 20 × 24-in. cylinders, carrying 190 lbs. steam pressure, and not exceeding 125,000 lbs. in weight, which had been giving excellent results. With this construction the rate of adhesive to tractive power was less than four, which was the figure recommended by the Association. The cylinders of high-speed locomotives should be well protected, and the steam and exhaust openings as large and as free as possible. The length of ports and the travel of the valve should be made as great as practicable without throwing too much stress on the valve gear. Inside clearance and setting valves, to reduce the lead at short cut-offs, correspondingly reduced compression and gave greater power at high speed, and also made the locomotive ride easier. Much had been accomplished in the direction of light reciprocating parts by the use of four bar steel cross-heads cast with hollow wings, hollow wrist pins, dish cast steel pistons, and channel main rods.

Good reports were made of the economy of compound freight locomotives. Personal knowledge was had of a compound freight locomotive that had shown a saving of 23% in pounds of coal per car-mile, as compared with the performance of ten simple locomotives, which, excepting the compound principle, were identical in construction. The expense of repairs on the compound was no greater than on the simple engines.

The Secretary's report showed the membership of the Association to consist of 566 active, 17 associate and 17 honorary members, making a total membership of 600. The receipts of the Association for the year were $3,583, and the expenditures $3,001. It was then announced that the annual dues for the coming year had been placed at $5, and the Association proceeded to the consideration of the reports of committees.

The first report in order was that on Exhaust Nozzles and Steam Passages. The committee announced that owing partly to a lack of funds and partly to lack of time and opportunity, it had been unable to carry on the necessary experiments, and had no report to make. After some discussion on the necessity of further experiments being made, and upon the advisability of the Association appropriating the necessary money, the subject was dropped without any action being taken.

The next report to be taken up was that on Locomotive Fire Kindlers.

Locomotive Fire Kindlers.

Little or no change has been made in oil kindling devices during the year, but a large number of experimental devices have been tried, as a rule, without marked success. The plan of introducing oil fuel under the grates was tried, but a heavy loss ensued from radiation from the ash pan, and the fire was not kindled so well as when the fire was applied above the fuel. Oiled waste has been tried, and independent kindlers, using a can of oil flowing by gravity to the kindler, but such devices are cumbersome, require more labor to handle, and increase the fire risks. The cost of compressed air has never been charged to oil kindler expenses, and we think it need not be for purposes of comparison with wood, for the reason that there are expenses in the handling of wood not charged against it as fuel that more than compensate for the cost of compressed air. By experiment it was found that a standard main air reservoir containing 15,800 cu. ins. of air at 70 lbs. pressure kindled three fires in ordinary eight-wheeled locomotives, using about 300 lbs. of fuel each. This goes to show that the amount is not excessive.

To get some idea of the efficiency and cost of oil kindlers, reports of actual results were obtained from a number of railways. Two of these show the actual number of fires kindled for a year, with the amount of

* Abstract of paper to be presented at the annual meeting of the American Society of Civil Engineers at Nantasket, Mass., June 18 to 22.

oil used and the cost per fire. These records cover all kinds of weather and locomotives, the fluctuation in price of oil, etc., and can be considered pretty correct. The accompanying tables show the results obtained. Of the several devices tried only one has come into anything like extensive use—viz., the Leslie kindler, which is used in 407 stalls and is being installed in 428 more. The Smith kindler is used on the Illinois Central Railroad, but it was impossible to get any further information than that it had worked well. That the oil kindler is past the experimental stage seems proven. There is no doubt of its efficiency. It saves labor and time, reduces fire risks, reduces the handling of fuel for kindling. Its cost, about $20 per stall, is easily saved in a year by its economy over wood.

Reports from the Chicago, Rock Island & Pacific and the Burlington, Cedar Rapids & Northern Railway Cos., showing the number of engines kindled, the average gallons of oil used per fire, with the average cost per fire in cents, from May 1, 1894, to May 31, 1895, are presented in the accompanying table.

Cost of Kindling Locomotive Fires by Months for the Year Ending May 31, 1895.

Chicago, Rock Island & Pacific Ry.

	No. engines kindled.	Av. gallons oil per fire.	Av. cost per fire, cts.
May	1,368	1.31	2.24
June	2,500	1.28	2.18
July	3,600	0.98	1.649
August	4,600	0.86	1.462
September	5,024	0.88	1.54
October	5,345	0.96	1.649
November	5,194	1.14	1.95
December	4,471	1.20	2.05
January	4,592	1.21	2.07
February	4,428	0.99	1.71
March	4,557	0.94	1.61
April	4,108	0.96	1.64
May	4,217	0.99	1.71
Total	54,094	....	....

Burlington, Cedar Rapids & Northern Ry.

May	415	1.329	3.00
June	474	0.772	1.69
July	470	0.882	1.853
August	679	0.950	1.992
September	737	0.900	1.787
October	889	0.838	1.800
November	779	0.831	1.745
December	646	1.024	2.148
January	713	0.852	1.789
February	604	1.250	2.625
March	645	0.640	1.345
April	563	0.940	1.974
Total	7,674	.....	.....

The discussion was opened by Mr. A. E. Manchester (Chic., Mil. & St. P.), who said: I think it would be desirable for this committee to be continued through another season. I am doubtful if the information obtained is all that should be obtained before we dispose of this subject. There are points to be considered in this connection that involve more than the kindling of the fire. Would there be any greater number of stay-bolts broken in firing up by these methods than with other fuels? Is it going to have any influence on the cracking of firebox sheets? There are also some other methods in force that require no more plant than those that have been mentioned. I think of one now in which it is the practice to use two sticks of wood in connection with the soaking of oil; using about four quarts of soaked waste in the kindling of a fire, using the two sticks of wood to assist in spreading the fire through the coal. This is successfully practiced in several hundred stalls at the present time. Requiring no plant, it is practical to put it in use at small points, like branch line runs, where but two, three or four engines are housed, as well as in large plants, where you have facilities for air blasts and blower. There is another consideration, and that is the use of the blower—whether that is a desirable appendix to the firing of an engine. I hope this subject will not be passed upon lightly; it is an important subject.

Mr. C. E. Fuller (Cent. Vt.): We are using the kindler mentioned in the report as the Le Bel kindler. We are using it without any oil or wood, and have never experienced any trouble with it. We fire up with a blower or without, using hot or cold water, as the case may be.

Mr. E. M. Herr: On the Chicago & Northwestern Ry. we have been kindling fires with oil extensively, but have superseded it in a number of places, notably on the Iowa divisions, not using the oil at all. We simply use dirty, oily waste as it come sfrom the wipers, and are finding that method very satisfactory as far as we have gone. It has only been in use a short time.

Mr. R. Atkinson (Can. Pac.): I have had some experience with the Le Bel kindler and made several tests. I have also made tests with oily waste, and succeeded with the blower in getting up steam, about 70 lbs. in about 1¼ hours. So far as I have tried the Le Bel kindler it has worked well. It did not work well at first, as we put the kindler below the coal. We afterwards found it was better to make a mound of the coal and put the kindler on top. Being of a resinous nature, when lighted, it spreads down through the coal. I made a test between two engines, one with wood and one with the Le Bel kindler, with cold water in each case, and the engines in the same condition as far as we could get them. It was also considered that we should debit the Le Bel kindler with the cost of some coal. I found in the course of the experiment that we had to put the same amount of coal on in each case. It was not a question of raising steam; it was one of getting the body of fire ready to go into service. I put 600 lbs. of coal with five sticks of the Le Bel kindler into the firebox of an eight-wheel engine, 300 lbs. of coal at the beginning, and balance afterwards. By the use of the blower, 70 lbs. pressure, we got first steam in 53 minutes; 70 lbs. of steam in 78 minutes; 120 lbs. of steam in 87 minutes. At that time the 600 lbs. of coal formed a body about 4 ins. thick on the grate, and the engine immediately proceeded to a train. In the other case, the lighting with wood, we used 95 lbs. of the best dry pine, scantlings and edgings without sap, wood or bark. We put 300 lbs. of coal on to commence with, and afterwards 200 lbs., making a total of 500 lbs. We got first steam in 37 minutes from time of lighting, 70 lbs. of steam in 57 minutes, and 120 lbs. of steam in 69 minutes. The coal fire was then very thin, and it was found necessary to add another 100 lbs. of coal and wait until it ignited before the engine was fit to move out and make a train.

Mr. David Brown (D., L. & W.): We take it for granted that the roads using kindlers are using soft coal; it ignites pretty freely. We are using hard coal, and I do not think we could obtain very great benefits from such a little flame in the first place. Our experience during the past 28 years has been lighting with wood in the usual way, and covering it slightly with coal, and allowing it to ignite as easily as possible, so as not to increase the heat on the plates too suddenly. Previously live coals were used for starting the furnaces. We had a furnace in which we burned coke, and when we wanted to start a fire in the engine, we would run in a couple of shovelfuls in the center of the firebox and cover it with coal. It is an easy matter to ignite soft coal.

This closed the discussion on fire kindlers, and the convention proceeded to consider the report on Shop Tests of Locomotives.

Shop Tests of Locomotives.

Owing to the inability of the committee to raise the money necessary for carrying out a series of shop tests, no tests were made. The tests proposed by the committee were briefly as follows:

(1) It is proposed to make a thorough test of the 17 × 24-in. simple engine now fitted up at Purdue University, and then convert it into an equivalent two-cylinder compound, and test under similar conditions as before, and obtain the difference in the economy of the same locomotive, when working with single expansion, and with double expansion. This locomotive fairly represents the medium-sized passenger engine in general use in the United States to-day.

(2) To obtain the economy of a larger locomotive, the committee recommends a test of a large ten-wheel locomotive with 20 × 24-in. cylinders, and boiler and firebox large in proportion. The effect of the large boiler and grate upon the steam economy would be shown, and incidentally the friction of the additional wheels and heavier bearings would be measured. This engine would be tested, and then converted into an equivalent two-cylinder compound, and the difference in the economy of its performance, when simple and compound, would be shown.

(3) The tests with the 17 × 24-in. engine will be known as the First Series; those with the 20 × 24-in. engine as the Second Series. Each series of tests will be made with various speeds, boiler pressures and loads, but in each separate run constant conditions will be maintained.

(4) It is thought that the most economical and efficient plan of operation will be to organize a small corps of operators, train them to the work, and proceed with th etests as rapidly and regularly as possible. The practice would be to make three tests per week, each test making a run equal to 100 miles.

It was estimated that the cost of these tests would be $7,400. In closing, the committee asked that the subject be continued.

At the conclusion of the reading of this report, the noon hour having arrived, the President stated that questions asked by members would be considered.

Mr. A. E. Mitchell asked the following: "Which is safer construction for a ten-wheel engine, swinging center truck and flanged forward drivers, or rigid truck and blind forward drivers?"

Mr. John McKenzie (N. Y., C. & St. L.): I believe Mr. Mitchell had one of his ten-wheel engines pulling a passenger train with a blind tire and rigid truck in front. The engine was running fast and struck something, and the front truck went off and the whole train followed the engine. Investigation showed that there was something wrong in the construction of the engine, and the conclusion arrived at was that if this engine had been equipped with a flanged tire forward it would not have left the rail; the truck would have gone off, but the flanged tire would have held the engine to the rail. The question of the swinging motion truck and flange tire forward depends upon the wheel base of the engine. We use the blind tire forward and a rigid truck; never had any off the track on account of the blind tire, and we have had mogul engines off the track with the flanged tire and swing motion truck. I understand they are putting flanged tires on all the ten-wheel engines; whether they are using the swinging motion truck I am not positive.

Mr. R. Atkinson (Can. Pac.): We built some ten-wheel truck and blind tires; is there much wear on the side of the truck boxes?

Mr. John McKenzie: No, there is not. We have been putting the cart before the horse for a number of years. It has been customary, of course, to put the tires on with the taper outward. We reverse that and put the largest part of the tire on the outside, so that on any curve the engine will go around without assistance from the truck at all. I find good results from this method.

Mr. R. Atkinson (Can. Pac.): We built some ten-wheel engines and put swinging motion trucks in front with blind tires, and the front of the engine would swing around 4 or 5 ins., heading for the fields. We also got two faces on the leading tire, a considerable number of hot boxes and lots of trouble. I discovered what was the matter, and then stiffened up the side play of the truck by putting in side springs as well as angular suspension. It has improved to some extent. We decided to follow the practice of some roads, and put a rigid center truck in. I have seen 2½ ins. side play on the leading truck wheels. For two years we have been gradually getting into practice, and have made it almost exclusive, putting flange tire forward, and using angular suspension links and side springs, with an initial compression of about a ton or a ton and a half. We can run an engine a year without getting more than ¼ in. wear. Before using flanges the wheels were generally cut more on one side than the other.

Mr. S. M. Vauclain (Baldwin Locomotive Works): It is our practice in building ten-wheel locomotives to put the flange tire in front of the blind tire and the middle wheel, supplying the engine with a limited swing truck. I do not think it is advisable to put long swinging links on the engine truck, as it makes the front end unsteady on straight line, although it admits the free curvature of the machine. If you have side play sufficient to allow the engine to take the position that engines formerly did when they were supplied with the Baldwin flexible truck, it does not make any difference how many flange wheels there are, or how long the wheel base; she will get around the curve in some shape. We have a curve of 40° leading out of the shop. It is a very sharp curve, and we have no difficulty whatever in running consolidation engines, ten-wheel engines, and, in fact, all engines from that shop, around that curve, except where the locomotives are specified to have flange tires on all the wheels. In a case of that kind we jack up the front end of the engine, and leave the back driving wheel to guide that end and the truck to guide the forward end.

I am of the opinion if flanged tires are desired, there can be no objection to them, provided you supply sufficient side play in your locomotive to do away with heavy friction on curves. If you have a straight line to run on you can put on a rigid center truck and flange all the drivers. We have built locomotives for railroads having severe curvature, with rigid center truck, and the front driving wheel flanged and main driving wheel plain. The truck boxes gave trouble, and front driving boxes gave trouble on opposite sides, proving that the engine bound tight on curves, and as there were more curves than straight lines they had trouble with hot boxes. When the engines were given limited-swing trucks and the flanged driver left where it was, there was no trouble from hot boxes or anything of that sort, and little trouble from side play.

I remember one case wherein we built a locomotive to perform certain work upon a very heavy and long grade, with curves running up to 9°. When the engine was standing on the curve—she was supplied with the rigid center truck and plain tires on the front drivers—she required 70 lbs. of steam to move, with ¾ in. play on the flange wheels. We took that same locomotive and changed the tires to flange tires on front driver and plain on middle wheel, limited-swing truck, not over 1½ ins. of motion, short link, requiring considerable pressure to move the front end, and the engine then could be started readily at any place. It was as good as one car more on the grade.

I personally advocate the use of plain tires on the intervening wheels of a locomotive, to be made sufficiently wide to keep on the track. The track must be in bad shape, if a plain tire driver, properly located, is going to drop in between the rails. I believe a ten-wheel engine should be supplied with a flanged tire on the front driving wheels, for fear of the derailment of the truck. If the truck leaves the track the engine is sure to follow. I know of a case in particular where the front truck was derailed, and the locomotive ran for a quarter of a mile before they could stop it, and the driving wheels remained on the track.

(Concluded next week.)

THE ANNUAL CONVENTION OF THE MASTER CAR BUILDERS' ASSOCIATION.

(Concluded from p. 392.)

Tuesday's Session.

In the discussion following the majority and minority reports of the committee on Interchange of Cars, which were abstracted in our last issue, each speaker was limited to five minutes, a fortunate provision, in view of the fact that the convention had to conclude its business by the end of the week. Everybody expected that the discussion on this topic would be a spirited one, and nobody was disappointed in this respect. Those in favor of the changes, however, seemed in the majority, and the discussion assumed a somewhat one-sided form. Some of the more important features of the discussion are abstracted in the following paragraphs:

Mr. Pulaski Leeds (L. & N.): I desire to draw attention to the restrictions that are noted in the minority report. When our committee met, it was decided that we were not to discuss the whys and wherefores; that we were simply to collect the expression of views as they came in and give the facts as they were presented. They say that we should have presented the other side of the question. The nature of the replies was such that we could not do this. We did not consider it necessary to go into an argument of the question, but presented the result of the inquiries which we made.

Mr. J. N. Barr (C., M. & St. P.): I should have preferred to have heard from some one in support of the minority report before speaking. We have raised quite a bugaboo about this thing. We say that we do not intend to let other people repair our cars. To speak approximately, I suppose there are a million dollars' worth of repairs on "bad order" cars floating through this country, so that anybody who feels inclined to make the repairs can do so. If that is not giving into the hands of other people the repairs of our own cars, I do not know what is. In addition to that, if any of us injures a draft-timber on a foreign car, or if there develops a crack, sometimes a season crack in a sill, we are at liberty to repair them, giving no notice to the makers. What is the result? Some person a thousand miles away repairs a car and repairs it improperly; and it passes along until it reaches the road of the owner. The inspector is familiar with the construction, and says, "We cannot take this car." The result is that the last holder of that car has got to pay the bill. There has been considerable said about the inequity of the plan under consideration. It seems to me there can be nothing more inequitable than the case just cited. There is not one of us who does not know of numerous cases in which cars are offered by foreign roads, and they say "We didn't make these wrong repairs." The answer is "That doesn't make any difference. According to M. C. B. rules, you will have to pay for them." Under the arrangement in force, any defect which may develop in a car away from home may be repaired without giving notice to the owner. He is in ignorance of it. With the new arrangement, there is a notice necessary, and the car owners will be better informed on that subject than they are now.

Mr. Wm. McWood (Grand Trunk): Nothing facilitates the movement of cars so much as the rules of interchange. I think they are fairly good as they stand now. The proposed extension of Rule 8 appears to me to be too broad. The great trouble with the present rules is want of uniformity. Mr. Barr very properly says that a car may be improperly repaired, and passed along until it comes to the road of the owner, when the owner will refuse to receive it. Here is exactly where the want of uniformity comes in. If we had more uniformity there would be less trouble.

Mr. A. M. Waitt (L. S. & M. S.): The M. C. B. rules have, undoubtedly, served a very valuable purpose in connection with the interchange of cars. They were adopted a number of years ago, when business was comparatively small compared with the present time; when we did not have refrigerator cars with meat passing from one end of the country to another with almost express train speed; when the rules were quite simple; when carding was a new thing and it was not carried out to the extent it is now; when many of the new features that are causing trouble—M. C. B. couplers, air-brakes, etc.—were not in existence. The M. C. B. rules do not at the present time fulfill all the requirements of the service, as is shown by the fact that at all the large interchange points there are special arrangements broadening the rules, but not in conflict with them. We have on our road, in connection with the Pittsburg & Lake Erie, an agreement, made a few years ago, by which we allow either road to repair cars of the other and make a bill. At Youngstown, the point where we interchange, we stopped our inspection, merely keeping a man to look after hot boxes, and anything that would interfere with the safe running of the cars. One man has done the work of five or six, and things go smoothly. We have arrangements at several points where we agree we will not set the cars back. It is necessary to prevent delays to traffic. Why not extend the same principle, as is proposed by the committee, by all agreeing to do this same thing—repair cars when they need it. That is the principle, as I understand it, that the committee is advocating. At Chicago it has worked a wonderful change in the reduction of defect cards. With regard to worn-out cars, they will be sent home just the same under this new arrangement as under the old. It will be an inducement to people not to put poor material in the cars when they build, as they will be responsible for it, as they should be.

Mr. G. W. Rhodes (C., B. & Q.): I was one of those who voted against this proposition last year. At the present time, after having had experience with the interchange of cars under the new interchange, we have changed our views and are in favor of the new interchange, and propose to vote in favor of it. What is it that makes this subject prominent at this time? It may not be so everywhere, but in the West there has been a heavy loss of business, and those in charge of expenditures have been put to their wits' ends to know how to make ends meet, and when we have seen the way in which our equipment has been handled, and the unnecessary expense that we are sometimes put to, we felt that some action must be taken.

I take it that one thing which makes the discussion at this meeting perhaps not as full as it ought to be is that a great many here are not voting about things as they know them; they are voting according to instructions from superiors. Without any disrespect to the superiors, I do not believe that they are as competent to judge of these details as the Master Car Builders are.

Mr. E. D. Nelson (Penna.): As I understand the history of the Chicago agreement, it began by twelve roads in Chicago making an agreement to practically adopt the rules which are recommended by this committee's majority report. I am not intimately acquainted with the Chicago interchange, but I think history will show that other roads went into it after the original twelve had it in practice for some time. Of course, those other roads, about 43, held back until they could see what the results were. Those who are in the Chicago agreement are, as we know, enthusiastic about it; and the principal reason is that they were having so many difficulties there that it was absolutely necessary to adopt something radical. We know that times come when we have to make a choice between two evils; but my impression is that it has not been in practice long enough to develop such other evils as may come from it, and which may not come out until after it has been in force for some time. I do not think the association as a whole should adopt this at the present time. I do not think there is sufficient information as to the way in which it will work over a large territory. We may come to this idea in some form or other, but I believe there are already some indications that the agreement as outlined and practiced at the present time may be profitably modified. Why not let these roads continue their agreement, and give the association the value of their experience after it has been in use a longer time, so that we will be better able to judge?

Mr. A. E. Mitchell (N. Y., L. E. & W.): The New York, Lake Erie & Western R. R. was one of the first to enter the Chicago agreement. We were one of the original twelve, and the agreement has given us relief in Chicago. There is no question about it; but I do not believe that we want to go into making that agreement universal until we have had further experience with it. It has been in force only a short time, and we are constantly having disputes, and it will make an immense amount of work for the arbitration committee. I say let us continue that Chicago agreement for another year; let us settle our disputes, creep before we walk, and next year, if we see fit, the other roads can take it up.

Mr. John McKenzie (N. Y., Chic. & St. L.): The members will agree with me that the rules of to-day are thoroughly impracticable and are not lived up to. This is shown by the fact that at all large interchange points we have a set of rules governing interchange of cars between our roads. In the Buffalo interchange between the New York Central and the Lake Shore and West Shore there are 22 special rules of interchange, supposed to be governed by the M. C. B. rules. With the Lehigh Valley we have probably as many more, and especially so with Rule 10, which has been a bugbear ever since it was adopted. I do not think there is a man here who will say that he has observed it in any particular until the Chicago interchange was introduced, and we have since had notices from many car owners that they would recognize bills under Rule 10. We have also had notices from roads in Chicago and other points that they would not card under Rule 10 for any of the defects for which owners were responsible, as outlined by the rule. The very fact that it has been found necessary to introduce rules governing interchange at these large interchange points is evidence in itself that the rules are not worth anything as they stand to-day, and there should be a radical change. I believe the Chicago interchange agreement is the proper thing. It is said it is going to increase our clerical force; but where we put on a $40 man in the office, we will take off four or five $60 interchange men.

Mr. Wm. Garstang (C., C., C. & St. L.): I indorse the sentiments of Mr. McKenzie, and agree with him that the present M. C. B. rules are not adequate to handle the large volume of business at our interchange points. I think that has been clearly demonstrated with our connections at Cincinnati. We tried to handle the business under the M. C. B. rules, each road employing its own inspectors. We could not get the traffic through. We agreed upon a joint inspector, and still it would not go through. He claimed he did not have enough assistance, and so we agreed to let him have two assistants. The business still did not go through satisfactorily to the management of the different roads. The joint inspector thought if he got charge of the inspectors he could control the business all right, and we turned them over, to let him handle them in any way he saw fit, to get the business through the yards, and still it did not get through. Our principal interchange was with the Chesapeake & Ohio road. About that time the Chicago interchange was proposed, and I am happy to say that the road I represent was one of the pioneers in the new interchange. Since the new interchange has been working, about six months, we have reduced our inspecting force account at Cincinnati $300 a month; and our Superintendent informs me that there never was a time when the Cincinnati yards were as free as they have been in the past three or four months. The business on our road is about 15% better than it was last year. We have handled more business in a given time this year than was ever known in the history of the road. There seems to be an impression here that this interchange does not benefit any place but Chicago; that is a mistake. We get the benefit of it at Cleveland and Cincinnati, and wherever we can find lines that will go into it. We have shown a reduction of 25% in defect cards issued on the end of the road where we have lines in the new interchange; on the other end the increase has been 15%.

Mr. S. P. Bush (P., C., C. & St. L.): From the arguments of those in favor of the Chicago interchange, there is only one idea in view—namely, the facilitating of the interchange of cars. Some of the ideas involved in making our present rules have been overlooked. In making them, the framers looked into the matter of equity, and it was their idea to provide certain safeguards for various purposes. I think that was the first consideration with them, and the facility of interchange the second. In order to facilitate interchange, they provided what is known as the defect card, which, as stated, is put on a car to indicate defects for which the owner is responsible. Another safeguard was to put a premium on the careful handling of the cars. It was laid down as principle that any railroad company receiving a car from another railroad company should deliver it back in as good condition, and was to be held responsible for all legitimate defects which might develop in service on its line due to rough handling. The Chicago interchange tends to throw away a little too many of these safeguards; it is too radical. The facility of interchange has been argued more than anything else. I do not think the feeling is general all over the country that freight is being detained. There are other arguments in favor of the agreement—the mileage of cars can be increased. The American Railway Association has had under consideration for several years a plan for that very purpose—the increasing of average mileage of cars. It is known as the per diem system. On the face of it the system is just, but they have not adopted it.

Mr. E. D. Bronner (Mich. Cent.): Some of the gentlemen speaking for the minority report have dwelt on the point that the only advantage we claim for this agreement is the saving of delay, and that they do not see that the country is suffering from delay to any great extent, or we would hear about it from the general officers. Our general officers are always after us on account of delays to freight. We have been trying to develop a business in the South through one of our connections, the Cincinnati, Hamilton & Dayton, at Toledo—consisting largely of early fruit and vegetables, which are of a perishable nature. We found that on account of the delays from the operation of the M. C. B. rules at Toledo—although the rules had been greatly modified with the object of taking from them much of their rigor—we could not get the freight through. A committee from the Board of Trade at Cincinnati came up to see our president, and the matter was talked over between the officers of the connecting road and Michigan Central, who evidently knew something of the Chicago agreement, and they instructed the mechanical departments of the two roads to enter upon that agreement. I telegraphed to my foreman to give me the result of the operation of the Chicago agreement at Toledo. The result is as follows:

Week preceding our entering upon agreement, interchange of 284 cars, issued 31 defect cards and received 39 defect cards. We placed upon our repair tracks 35 cars of the C., H. & D. It is presumable they re-

paired as large a number of our own. First week after the operation of the Chicago interchange, 251 cars interchanged, two defect cards issued by us, four received; repaired three of the C., H. & D. cars. Second week, interchange of 329 cars, issued one defect card, received one; repaired two C., H. & D. cars.

Mr. W. S. Morris: I confess, like Mr. Rhodes, to being a convert to the new system. I voted against it at the last convention, and while there are a good many reasons and positive figures that I could give, I will simply give a few figures, which will show the manner in which the cars have been interchanged at our Cincinnati connection:

For the months of February, March and April, 1894 and 1895, cars were cut out for repairs at the yards at Covington, Ky., as follows:

	1894.	1895.
February	174	73
March	190	105
April	157	80
Total cars	521	258
Total trains	167	134

In 1895 the Chicago rules of interchange were in force.

Wednesday's Session.

The revision of the M. C. B. Code of Rules of Interchange was taken up Wednesday morning, and this work occupied the entire time of the session. In the report of the Arbitration Committee it was recommended that the revision of the rules be made along the line of the Chicago agreement, which had been so thoroughly discussed on the preceding day. With the view of getting at the opinion of the members on the advisability of such wholesale changes, it was decided to vote on this recommendation at once, and then proceed with the revision along the lines of the Chicago agreement or not, according as the vote was favorable or unfavorable. After some short discussion on the best method of procedure, the recommendation was therefore put to vote and lost, the necessary two-thirds votes by cars not being in favor of the changes recommended. The vote by cars stood, 666 ayes and 458 nays.

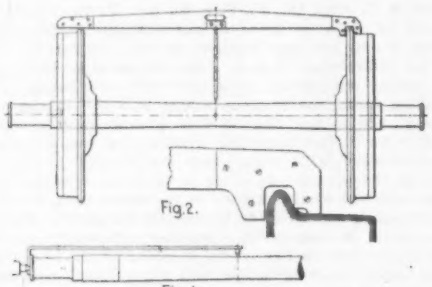


Fig. 2.

Fig. 1.

Figs. 1 and 2. Diagrams Showing Application of Gages in Mounting Car Wheels.

The Code of Rules was then taken up section by section, and a few minor changes made. As usual, the suggested changes were numerous, and the greater part of the time was consumed in the discussion and rejection of these.

Thursday's Session.

The first business taken up was the reading of the report on the Mounting of New and Second-Hand Wheels, which it was necessary to dispose of before the correction of the interchange rules could be finished. The following is an abstract of the report:

Mounting New and Second-Hand Wheels.

The committee recommends: (1) that the gage shown in Fig. 1 be used for determining the center of the axle, and that all axles be centered prior to mounting; (2) that the gage shown in Fig. 2 be used for locating the first wheel; (3) in mounting second-hand wheels, the committee recommends that if flanges were worn to not less than 1¼ ins. in thickness, they should be mounted as new wheels. If the flanges were worn to less than 1¼ ins. in thickness, wheels should be mounted so that the gage between flanges measured 4 ft. 5½ ins. instead of the standard 4 ft. 5⅝ ins. It was the opinion of the committee that practical results would be obtained in mounting second-hand wheels in this way, and that an attempt to work closer than this would simply result in an elaboration of precaution and measurements that would never be carried out. The committee also recommended that wheels with flanges worn to a thickness of 1⅛ ins. should not be remounted.

Mr. A. M. Waitt (L. E. & M. S.): There are some points which it seems to me the members ought to consider carefully before acting upon this report. Fig. 1 shows one end of the check gage, the shape of which is exactly the shape that was adopted as our standard check gage last year. It may have been the experience of other members, as it has been mine, to find that this check gage is applicable to new wheels, but that if the flange is worn sharp at all, the measuring point, which is 17-64 in. above the tread of the wheel, does not come in contact with the flange of the wheel, and that the projecting point, which is 1-16 further out, does. In other words, a wheel would be admitted by the check gage if the flange was worn out to 4 ft. 6 11-16 ins. instead of 4 ft. 6¼ ins., which we have adopted. We ought to correct that. When the Association goes before the country and also presents its standards to the American Railway Association, we should have them consistent with practice and our gages should be such that they can be used for the purpose for which they were intended.

The committee from the Pennsylvania R. R., whose report was included in the report of the committee on wheel gages, made last year, showed a shape of check gage where the measuring point was really a point—it was not an extension on the radius of the throat of the flange of the wheel. That form of gage was all right, and measured at the point intended. As the point would naturally wear off, the committee enlarged it by extending it upwards for ⅛ in. on the ⅝-in. radius that the throat of the flange has. This threw it out so that it would not measure where it was intended with a wheel that had a worn flange. If the committee had thrown the radius downward ⅛ in. instead of upward, that would have made a bearing point that would be large enough to stand some wear and at the same time would always have measured a wheel where it was intended, 17-64 in. above the tread. I think it is important that the matter be referred to a proper committee for consideration as to the advisability of making a change. There is another point in connection with this subject. We have adopted a check gage of 4 ft. 6¼ ins. We also have a standard distance between wheels for mounting, viz., 4 ft. 5⅝ ins. We have also adopted a standard for the flanges of new wheels, the maximum being 1 7-16 ins. If you add 1 7-16 ins. to 4 ft. 5⅝ ins. you find that under our standards for mounting wheels we get a wheel that will not pass our check gages. Our standards are inconsistent by 1-16 in. The report of the committee has recommended a practice in mounting the wheels which gives three different distances between flanges, according as they are new, worn slightly, or worn a good deal. It seems to me that this matter of making our wheel gages consistent with each other ought to have more practical consideration by this Association. I move that the matter in regard to wheel gages be referred to a committee for further consideration and to report another year.

Mr. N. J. Barr (C., M. & St. P.): There are, of course, standard sizes for flanges, but when you come to use the gage with wheels having thick flanges up to the limit allowed, you get into trouble. The committee understood these points very well, but it decided that it was not going to touch them. This committee was on remounting second-hand wheels, and it tried to keep right to the subject.

The motion made by Mr. Waitt was carried, and the convention then resumed the discussion on the rules of interchange. A number of rules which had been passed the day before were reconsidered and a few changes made. The report of the Committee on Road Tests of Brakeshoes was then read.

Road Tests of Brakeshoes.

The manner of making the road test of brakeshoes was to equip one truck of each car with a soft cast iron shoe and the other truck with the shoe to be tested. Altogether 568 shoes made by eight different firms were tested, 236 being applied to steel-tired wheels, and 332 to cast iron wheels. The cast iron reference shoes were all made at the Altoona shops of the Pennsylvania R. R., care being taken to get them as near alike as possible. The tests were made on seven different railways. The cast iron wheels were mostly 33-in. wheels, while the steel-tired wheels were quite evenly divided between 33-in., 36-in. and 42-in. wheels. In computing the relative cost of these several brakeshoes which were under test, it was necessary to work out the actual net cost of the metal worn off. The method followed in computing the service cost was to take the weight and cost of one new shoe and the weight and value of one shoe scraped; the difference in weights representing the metal worn off in service, the difference in value representing the net cost of that metal, and the quotient arising from the division of one quantity by the other representing the net cost per pound of the metal worn off in service.

Table Showing Wear and Cost of Worn Metal of Fourteen Different Kinds of Brakeshoes as Compared with the Wear and Cost of Soft Cast Iron Brakeshoes.

Kind of shoe.	Made by	Steel-tired wheels. Wear by wt. rel. to soft cast iron for same service.	Steel-tired wheels. Net cost per lb. metal worn, cts.	Steel-tired wheels. Rel. cost for same service, cts.	Steel-tired wheels. Cost rel. to soft cast iron for same serv.	Cast iron wheels. Wear by wt. rel. to soft cast iron for same service.	Cast iron wheels. Net cost per lb. metal worn, cts.	Cast iron wheels. Rel. cost for same service, cts.	Cast iron wheels. Cost rel. to soft cast iron for same serv.
Soft cast iron	Penn. R. R. Co.	1.00	2.08	2.08	1.00	1.00	2.08	2.08	1.00
Hard cast iron	Ramapo W. & F. Co.	1.06	2.81	2.98	1.43	.86	2.81	2.41	1.16
Soft O. H. steel	Solid Steel Co.	.42	7.65	3.21	1.54	.17	7.65	1.30	.62
Hard O. H. steel	Solid Steel Co.	.31	7.65	2.37	1.14	.10	7.65	.76	.36
Malleable iron	Dayton Mal. Iron Co.	.51	2.37	1.21	.58	.53	2.37	1.25	.60
Spec. S. T. malleable iron	Dayton Mal. Iron Co.	.67	2.37	1.59	.76	.83	2.37	1.97	.94
Spec. C. W. malleable iron	Dayton Mal. Iron Co.	.81	2.37	1.92	.92	.83	2.37	1.97	.94
Congdon	The Sargent Co.	.30	3.06	.92	.44	.31	3.06	.95	.45
Meehan	The Sargent Co.	.21	6.70	1.41	.68	.31	6.70	2.08	1.00
Lappin	Lappin B. S. Co.	.35	5.41	1.90	.91	.55	5.41	2.98	1.43
Safety	Safety B. S. Co.	.77	3.65	2.81	1.35	.70	3.65	2.56	1.23
Soft steel (pressed)	Schoen Mfg. Co.	.29	5.63	1.63	.78	.11	5.63	.62	.30
Wrought iron (pressed)	Schoen Mfg. Co.	.29	5.78	1.68	.81	.11	5.78	.64	.31
Sargent Special	The Sargent Co.	.33	4.80	1.58	.76	.22	4.80	1.06	.51

The results of the tests in a condensed form are given in the accompanying table.

By vote of the convention the discussion of this report was deferred until the report of the Committee on Laboratory Tests of Brakeshoes had been read, in order that the two reports might be considered together. The report of the Committee on Laboratory Tests is abstracted quite fully in another column of this issue. The report was accepted by the convention, and on the motion of Mr. R. P. C. Lunderson the committee was ordered continued for another year, with an appropriation of $1,500, to carry on further experiments. By a similar motion the Committee on Road Tests of Brakeshoes was also continued, with the idea that the two committees should work in conjunction and present a joint report next year.

The discussion was opened by Mr. A. M. Waitt, who was followed by Mr. D. L. Barnes, Mr. S. P. Bush, and others.

Mr. A. M. Waitt (L. S. & M. S.): The committee on road tests has stated that it was not deemed advisable, owing to some practical difficulties, to make a determination as to the effect of the brakeshoes on the tire of the wheels. Many of the indicators or gages for determining or indicating the wear on tires and wheels are expensive, or difficult to use. In the work that was done by the Lake Shore & Michigan Southern R. R., it was determined to get as accurate an indication as possible as to what the effect of the brakeshoes was on the chilled wheels, and also on the steel tires. We found quite a simple and accurate method of doing this, which I would like to present to the convention, together with the facts that we obtained, as such data surely have an important bearing on the question of the use of different kinds of brakeshoes. Instead of using anything in the way of a gage which might show by means of a pencil the contour of the wheel tread, we adopted a form of flask for making plaster casts.

This flask is placed over the wheel at a point which we indicate with a prick punch mark, and is filled with quick-setting plaster of paris, the wheel tread being greased, so that the plaster will not stick to it. These casts are labelled, indicating the number of the car, and the number of the wheel, and the kind of shoe. After the special shoes were worn out, we took a second cast, and when any changes were made we also took some casts of the wheels that were removed, and also the wheels that were applied. Diagrams were made from these plaster of paris casts. From these diagrams we were able to judge of the comparative wearing effect of the different metals on the wheels. The results are not found to be entirely in accordance with the friction. Sometimes it has been said that the shoes which will last the longest will wear the wheel the most. That was not found to be the case; the friction and the wearing properties of the shoes were not in any regular ratio. Believing that it would be interesting to the members to have these data, I give them briefly.

It is found that the wear of the following special shoes is about equal to the wear of soft cast iron shoes: Cast steel shoe, B, on steel wheels; Meehan shoe, I, on cast wheels; malleable shoe, G, on steel wheels; malleable shoe, G, on cast wheels; safety shoe, K, on steel wheels; safety shoe, K, on cast wheels; Congdon shoe, H, on cast wheels; Sargent shoe, N, on cast wheels; malleable shoe, F, on cast wheels; malleable shoe, F, on steel wheels; Lappin shoe, I, on cast wheels; Sargent shoe, N, on steel wheels; malleable shoe, E, on steel wheels.

With the balance of the shoes the result were: Wrought iron shoe, M, on cast wheels, more wear, with the tread of wheels badly grooved; on steel wheels, wear three times as much as on cast iron. The Schoen pressed steel shoe, L, wore the cast iron wheels slightly less than the common cast iron shoe, but on steel wheels wore the tire about 50% more. Soft open hearth steel

shoe, C, on steel wheels, wore four times as much; Lappin shoe on steel wheel, 50% more; open hearth steel shoe, D, the same; wrought iron shoe, M, on steel wheel, three times as much; Meehan shoe, I, on steel wheel, twice as much as the soft iron; Congdon shoe on steel, twice as much.

Mr. D. L. Barnes: I wish Mr. Waitt would tell us how accurate he thinks his measurements are. The measurements are apparently complicated with the rail wear, and we should know what the limitations are to his measurements. Is it his opinion that his measurements are accurate representations of the wear, or are there incidental variations?

Mr. A. M. Waitt: I would say that as the special shoe and cast iron shoe were used on the same car, and made the same mileage, I have assumed that the rail wear would be the same on both, and that we got a pretty accurate comparative record as to what the wear by the brakeshoe was.

Mr. G. W. Rhodes (C., B. & Q.): I think the members of the convention would like to know in a general way from the committee whether in the matter of metal for cast iron wheels they have found that the brakeshoes which are generally used—that is to say, the cast iron shoes made of hard material—are the best material to be used against cast iron wheels in freight service; or has some other metal been demonstrated to be better than that?

Mr. S. P. Bush (P., C., C. & St. L.): The safety brakeshoe, which is composed largely of cast iron, gives the greatest friction, and that gives the greatest retarding power. You can stop a train quicker with the soft cast iron shoe in freight service than you can with any other. The question of wear does not come in. The results of the road tests indicate pretty clearly to what extent that question plays a part; and no doubt the joint committee will be able to tell definitely at the next convention which of the shoes are the most practicable in all respects for freight service.

Mr. D. L. Barnes: In making a summary of these tests, I find the three shoes most commonly used in freight service on chilled wheels are about as follows: That the average braking power for soft cast iron is 28%; hard cast iron, 18%; Congdon shoe, 18%; making the Congdon and hard cast iron the same. In the report on service test you will see that the wear of the hard and soft cast iron is practically the same, while the Congdon shoe is only 30% of that, showing that the Congdon shoe, so far as wear and friction are concerned, is superior to the hard cast iron shoe. But outside of the fact of the friction of the shoes we ought to understand what it is we consider in an emergency brake stop. We have the Westinghouse Air Brake Co. test, and these are made with soft cast iron shoes, to show the possibilities of braking for safety. Now a train running at 40 miles an hour can make an emergency stop within 600 ft. with soft cast iron brakeshoes, with an unloaded car, not a full car, as is often understood. When the car is loaded, instead of the braking force being 70%, it is 23%, which would increase the distance to 1,800 ft. by ratio. If in place of the soft cast iron shoe you put on a hard cast iron shoe with 18% friction instead of 28%, this distance would be doubled, or 3,600 ft. An emergency stop with a loaded train requires 3,000 ft. For safety you are forced to the soft cast iron shoe, while practical operation may demand the use of the hard cast iron shoe. I think it is well that this point should be understood, because it must affect the report of the committee next year as to the most acceptable brakeshoe.

Mr. J. N. Barr (C., M. & St. P.): Railways to-day are suffering an immense loss from sliding wheels, which would indicate that we do not need to probe very deeply to find something to increase the co-efficient of friction. This point should be considered.

Friday's Session.

After some routine business the report of the committee on Lubrication of Cars was read.

Lubrication of Cars.

The committee which was continued from 1894 reported that it had been unable to make the shop and service tests which would be necessary to secure information of value. It had looked up such shop tests of lubricating oils as had previously been made and presented as parts of its report a description of the tests made for the Standard Oil Co. some years ago, taken from the paper presented to the American Society of Mechanical Engineers in 1890* by Phof. J. E. Denton. In addition to this the report contained a reprint of the address on "History of Attempts to Determine the Relative Value of Lubricants by Mechanical Tests," delivered before the American Association for the Advancement of Science in 1890, by Prof. J. E. Denton.

In concluding its reference to these papers, the committee stated that it was satisfied that but little satisfactory information could be obtained from shop tests. One important feature to be determined was the comparative wearing qualities of different mixtures of metals and the comparative wear of journals. Actual service tests on cars were necessary for this purpose. It would be advisable to have these tests made on at least 10 different railways located in different parts of the country. The committee suggested that the question of these tests be held in abeyance until the better general condition of railway business would insure the hearty co-operation of railway companies in the work.

* Eng. News, May 24, 1890, p. 285.

Mr. D. L. Barnes: The report says: "The general sentiment on the larger roads in the country is that the high-grade oils are the cheapest in the end, all points being considered." How are we to determine what makes high-grade oils if shop tests cannot be made to show it? Is it quite fair to decry shop tests as much as this report does? We have in this report omitted to give credit to the shop test for what it is worth; and we are mistaking the errors of inspectors in drawing conclusions for the errors of the machine. The machine is true, as far as it goes.

Mr. A. M. Waitt (L. S. & M. S.): It was not the intention of the committee to decry shop tests; but it has been shown by the experiments of the largest oil company in this country—possibly the largest in the world—that the results of shop tests did not correspond with the results of actual service, as the conditions could not be fully reproduced, and therefore, they did not deem it wise to continue experiments in that line. On some other points I have taken the ground that service tests were better to base final judgment on than shop tests—namely, in connection with the coupler question. I think the same is true with the oil question and journal-bearing question. Shop tests must be taken with a great deal of latitude, because the actual conditions of service are not duplicated. Unless you are sure that the conditions are duplicated, you do not want to base a final conclusion on the shop test.

Mr. J. N. Barr (C., M. & St. P.): I suppose a high-grade oil is one you pay 20 cts. a gallon for, when you could get some kinds for 5 cts. a gallon. We use in general on our road an oil for which we can run passenger cars at about 13 cts. a thousand miles. I have taken that oil and put it on a special car, on a special train, on a special test, and run the car at a cost of 5 cts. a thousand miles. If you took that oil and made a test in the laboratory you might get still better results. If you could take the laboratory test, and put in the proper amount of dust, the proper amount of ignorance of the man pouring the oil, and proper amount of laziness of the car inspectors—I doubt not that in the laboratory you would get tests equivalent to those on the road. We have got to be careful about drawing conclusions from laboratory tests. I believe in scientific tests, but we do not want to put too much stress on them, as opposed to practical experiences. We said to the men on the St. Paul road, if you do not bring the consumption of oil down, we will discharge you. After two years and the discharge of a few men that could not use less oil, we cut our consumption in two. We can use high-grade oils or low-grade oils, but we will not get the results unless we follow them up in the proper executive manner.

Mr. G. W. Rhodes (C., B. & Q.): These figures show the cost of lubricants per 1,000 miles for freight cars on our road from 1885 to 1894:

Year.	Cents.	Year.	Cents.
1885.....	13.05	1890.....	12.78
1886.....	14.04	1891.....	14.04
1887.....	10.11	1892.....	14.74
1888.....	12.57	1893.....	14.61
1889.....	11.32	1894.....	7.68

From the figures you will see that the cost per 1,000 miles really increased until we got to 1894. The figures on the left relate to low-grade oil; those on the right to high-grade oil. In 1893 and 1894 we had to look after our expenses in a way that we never did before. Toward the end of 1893 every one on the C., B. & Q. road was, through proper agitation, interested in the question of oil. It became next to impossible for any man to waste oil. The figures of 1894 were brought down to 7.68 cts. and we are doing as well this year, if not a little better. I feel confident that had we used the same efforts in 1889 as in 1894 we should have had practically the same result; it might have been 2 or 3 cts. indeed, in place of 7 cts. There are certain places on railways where expenses are buried and you do not come in touch with them; and it is because accounts are not kept with sufficient accuracy to enable those in authority to keep a check on them.

Mr. A. E. Mitchell (N. Y., L. E. & W.): I substantially agree with Mr. Rhodes. We have been using the high-grade oil for six or seven years; I think the same as he uses. We keep an accurate account of all oil used, and make a statement each month of the oil used against the mileage. Last year our cost was 8 cts. per 1,000 miles. That has been the average for four or five years. We keep a record of hot boxes, and since we have introduced this system we have fewer hot boxes.

Mr. W. S. Morris (Ches. & Ohio): I would like to know if Mr. Rhodes has made a laboratory test and comparison of the oils used from 1885 to 1889, and from 1890 to 1894, and what the test developed, comparatively.

Mr. G. W. Rhodes: I was hoping not to be asked this question. In this report and from careful investigations that have been made, it has been said that you cannot determine definitely the merits of high-grade or low-grade oil in a laboratory testing machine. We endeavored to determine the difference, and we are compelled to join in with the opinion expressed in the appendix. We have not been able to determine the difference between them.

Mr. R. P. C. Sanderson (N. & W.): In following up the question of lubrication, we found that where we thought the oils were at fault, sometimes the brasses were at fault. A little irregularity at the back of the brass, which might be bearing improperly on the journal or bearing too hard against the collar, would run the expense of hot boxes up very materially. Seeing that covers were put in the dust-guard grooves; the fitting of the journal backs; all have a bearing on the oil consumption and number of hot boxes. Road tests, however carefully carried out, will bear with them all the uncertainties incident to a want of positive knowledge as to how well the brasses fit in the wedges: how true they are; how well the dust-guards are kept up; how much oil is forced out of the backs by the loosening up of the waste. These points all have a bearing, besides the quality of the oil.

Mr. E. W. Grieves (B. & O.): Some five or six years ago the Baltimore & Ohio was using cheap oil; 5 or 6 cts. a gallon. We went into the use of the high-grade oil; 25 cts. per gallon, for freight and 35 cts. per gallon for passenger cars. We found the first year we saved between $50,000 and $60,000. This was accomplished by a careful watching of our oil boxes, getting first-class brasses, and gaging and having our brass bearings and wedges of proper dimensions. We watched our dust-guards very carefully, and also had an inspector to see that the oil was not wasted. At this time we are still using high-grade oil, and it costs us 9.05 cts. on freight and 30 cts. on passenger cars, per 1,000 miles. We have a heavy grade road. We think we are doing very well in the use of high-grade oil.

Mr. E. D. Bronner (Mich. Cent.): The gentlemen all seem to attribute the favorable results obtained to the use of a high-grade oil, and consider that the grade of the oil is regulated by the price. Judging by price, we are using a low-grade oil; but we find we can run our freight trains at a cost of 6 cts. per 1,000 miles. We possibly may use more oil than some of the gentlemen using the so-called high-grade oils. I think one of the reasons that they have reduced the cost is because the oil costs so much that they are forced to watch and economize more closely. If the same care was employed with the low-grade oils they might get better results than they do. The principal economy comes in from the care of the details.

Air-Brake Tests.

The committee recommended that the following code of tests be adopted by the Association as recommended practice:

Conditions of Tests.—(1) The brakes will be tested on a rack representing the piping of a fifty, 34-ft.-car train; all cocks, angles and connections being as nearly as possible identical with those in train service. (2) Tests will be made with a uniform train pipe pressure of 70 lbs. (3) Triples must be so constructed that they can be secured and operated on the standard rack. (4) To secure accuracy in measurement of time application and release tests, electrical recording apparatus will be used, and so arranged to give an indicator on the fiftieth car. (5) Tests shall be repeated three times under the same general conditions. The temperature shall be recorded at the time of the tests. (6) Triples shall be classified Nos. 1, 2, 3, and outlawed. In grading triples the reasons for their classification shall be given. (7) The three essentials for a quick-action brake are as follows: (a) Graduation; (b) release; (c) quick action.

Application Test.—(1) Brakes must show with full service application, and 6 ins. piston travel, a brake cylinder pressure of 50 lbs. The minimum pressure must not be less than 48 lbs., nor the maximum pressure more than 52 lbs. The test will be made with 4 ins., 6 ins. and 12 ins. piston travel. The necessity for the 4-in. and 12-in. piston travel will depend upon the character of the brakes tested. (2) In emergency tests brakes must be applied on the fiftieth car with at least 45 lbs. pressure, with 6 ins. piston travel in three seconds from the first movement of the engine driver's handle. They should indicate at least 55 lbs. pressure in 3½ seconds. The final maximum pressure in this test must not be less than 15%, nor more than 20%, above the pressure given by the same brake in full service application. This test will be made to determine that quick action is obtained in each case, with 4 ins., 6 ins. and 12 ins. piston travels. (3) Commencing with the first car from the locomotive, the brakes of three successive cars, or less if they fail to jump three, will be cut out until the fifth, sixth and seventh are cut out, the brakes in each case to be applied as in test No. 2. After the first series of three has been tested, in order to test the second series the first car must be cut in, and so on. The quick-action brake should pass the three cars cut out and apply on the fiftieth car in the same time as in test No. 2. Tests will be made with piston travel of 4 ins. In addition, at least two other applications shall be made with three successive triples cut out in any portion of the rack beyond the fifth car.

Graduating Test.—Having secured 70 lbs. pipe pressure, the following tests shall be made: (a) A reduction of 8 lbs. in pipe pressure, which should apply lightly the 50 brakes; (b) a further reduction of from 4 lbs. to 6 lbs., which should increase the braking power on all of the brakes; (c) a reduction to 30 lbs. should equalize the pressure between the auxiliary reservoirs and

brake cylinders. The piston travel in this test will be 6 ins.

One or more triples shall also be tested, having substituted for the brake cylinder a reservoir having the capacity of a cylinder with an 8-in. stroke. The first admission to the cylinder should be made with a reduction of train pipe pressure not exceeding 5 lbs., each succeeding reduction should reduce the pressure in the auxiliary reservoir not to exceed 3 lbs., until full equalization takes place. The pressure in the train pipe should not be more than 3 lbs. lower than the equalized pressure in the brake cylinder and reservoir in full equalization.

Sensitiveness of Service Valve.—Three valves selected at random will be taken for this test, and each tried separately. They will be tested on a train pipe representing a locomotive and one car, the locomotive and tender brakes being cut out. A train pipe pressure of 70 lbs. having been secured, the air will be discharged as rapidly as possible through an opening in the engineman's side valve of from 2-64 to 3-64 in. in diameter. Under this condition the service action must take place and continue to take place without any appearance of quick action until the disk has been enlarged up to and including a 10-64-in. opening.

Sensitiveness of Quick-Action Valve.—The same three valves as were used in the test preceding, or others selected at random, will be taken for this test, and each tested separately, with the same train pipe and engine and tender brakes cut out. A train-pipe pressure of 70 lbs. having been secured, the air will be discharged, as in the preceding test, through disk openings, increasing in diameter by increments of 1-64 in. Triples must not show a range of more than 3-64 in. before full quick action is reached. Full quick action must not take place before 11-64 in., but must take place when the opening is 14-64 in.

Holding Power of Brake.—In service application gages will be placed on the cylinder and auxiliary reservoir of the 1st, 25th and 50th cars, with 70 lbs. train-pipe pressure. Brakes will be applied by admitting as nearly as may be 15 lbs. into the cylinder of the first car. Record of pressure in the auxiliary reservoirs and cylinders will be taken at first application and five, ten and fifteen minutes from first application. In quick application tests the test shall be conducted the same as just described, except that all the air will be exhausted from the train-pipe.

Dummy Cylinder Test.—A modification of the holding test by the introduction of dummy cylinders.

Release Test.—With the main air reservoir cut in any pump or boiler, pressure may be used that will maintain a uniform pressure of 90 lbs. A uniform pressure of 70 lbs. having been obtained in the train-pipe, all the air will be exhausted by a quick-action application. A pressure of 90 lbs. will then be maintained against a diaphragm perforated by a 3-32-in. hole, and a record taken of all brakes that release inside of 30 minutes. In making this test especial care must be taken to see that there is no leak in the train-pipe. It will not be considered satisfactory if a greater proportion than 10% fail to release in the prescribed time.

Time of Charging One Auxiliary Reservoir.—(1) Cut out the brake to be tested; (2) bleed the auxiliary reservoir empty and close the bleed cock; (3) keep the pump running and maintain a head of 90 lbs. in the main air reservoir and train-pipe; (4) cut in the brake to be tested and note from the reading of the gage the time occupied in charging to 70 lbs. This time should be 55 seconds, and never less than 45 seconds nor more than 60 seconds.

To Determine Whether Quick Action will Follow a Service Application.—Commencing with a service application of 20 lbs. pressure in the first cylinder, a full quick-action reduction will follow. It will be observed whether quick action takes place or not. The pressure in the first cylinder will be increased or decreased by steps of about 5 lbs., until the point at which quick action ceases or commences is determined. Quick action should take place with not less than 20 lbs. pressure in the first cylinder.

Train Tests.—In order to provide against defects which the rack tests just described may not develop, it is recommended that railways make a 50-car train test in actual service before accepting the results of the rack tests as final.

In closing the report the committee stated that while four classifications of triplets had been advised, it was recommended that classification No. 1 be adopted by the Association as its standard.

The discussion was opened with some criticism of the advisability of classifying triples as was done in the report, and upon the motion of Mr. R. H. Soule Norf. & Wn.) it was voted that the rules be adopted as recommended practice and not as standards.

Mr. A. M. Waitt (L. S. & M. S.): It is hardly feasible for each road, as it is in the market for something of the kind, to conduct a series of tests, and the members should have the benefit of the apparatus devised, and ought to have the benefit of the experience of the members who have worked on this Air-brake Committee. It would seem to me a wise thing to have a standing committee on air-brakes, not to make a report each year, but a committee to which any new triples brought out can be referred, and the members can know whether they pass successfully the requirements of the recommended practice. I move that there be a standing committee appointed, which shall be subject to changes from year to year by the Executive Committee, and which shall take charge of conducting and reporting upon the tests of such triples as may be submitted to them by the railways represented in the Association.

This motion was carried, and the report of the Committee on Air-brake and Hand-brake Apparatus on Cars was read.

Air-brake and Hand-brake Apparatus on Cars.

Through replies to a circular of inquiry, it was found that the location of the hand-brake wheel on passenger cars was not considered of great importance. The question of lack of power in hand-brakes was answered, practically unanimously, that no increase was recommended. It was generally recommended that a scale of prices covering labor charges for air-brake work should be established by the Association.

The report states that investigation reveals the fact that the present standards for air-brakes on freight cars are not especially well adapted to light-weight cars. To correct these difficulties, it was thought advisable to recommend the use of a 6-in. brake cylinder or auxiliary levers on light cars. This proposition met with general disapproval by members. From replies representing 290,612 cars, but one road, representing 17,312 cars was found that was using truck levers in the ratio of 6 to 24, as required by the standards. It appeared that a very great variety of ratios of truck levers were used. On account of this, and in view of the fact that 6 to 24 truck levers were evidently not suitable for general adoption, the committee had in mind recommending the adoption of a standard system of truck and floating levers and a standard cylinder, but out of the total of 290,612 cars represented in the replies only the representatives of 98,549 thought it practicable to do this. The report closed with a scale of prices for air-brake work.

Mr. E. W. Grieves (B. & O.) asked if the committee had ascertained the reason for the use of so many different ratios for brake levers.

Mr. E. D. Bronner (Mich. Cent.): The levers we present show the levers used by the roads replying to the circular. Some roads using several styles on their own equipment stated it was on account of the construction of the trucks, and that it would be impossible to use a standard lever unless there was a standard truck.

Mr. A. M. Waitt (L. S. & M. S.): In connection with the report comes another matter relative to the air-brake as we have it on our present standards. The standard for equipping cars with air-brakes is not considered practicable on account of its being the detail drawings of one of the roads, simply. I think it is worth while to have it looked over, and to eliminate the parts which are not essential or practicable, and retain the parts which are practicable. I think the sheet provides for a truck rigging hung between the wheels, and does not provide for the levers and connecting rods of outside hung trucks. I move that a committee be appointed for the purpose of looking over and revising the sheet and bringing in their report to the next meeting.

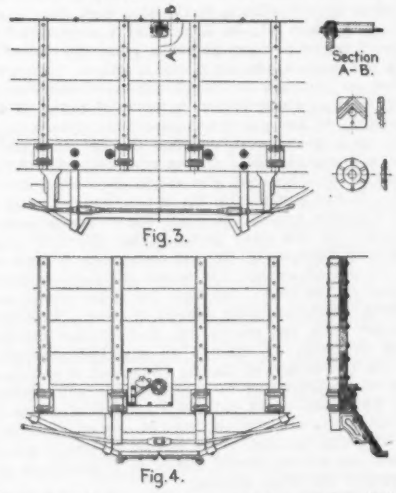


Fig. 3.

Fig. 4.

Figs. 3 and 4. Recommended Coal Car Sides.

Mr. E. D. Bronner (Mich. Cent.): The committee last year, in examining very carefully the sheet of standards referred to, found that its essential parts were being observed very largely, although in the detail it was not observed. We thought it might be well to recommend details that would be suitable for general adoption; but in looking over our replies we found there were 250,000 cars for which it would not be possible to recommend any standard as to details, as against 98,000 for which it would be. The committee concluded that no standard could be adopted. I think Mr. Waitt's motion a good one.

Mr. J. N. Barr (C., M. & St. P.): I amend Mr. Waitt's motion, to the effect that a committee be appointed to go over all the standards. Let us have a committee to look over the standards, not with the idea of changing them, but to give information each year as to how extensively they have gone into use; whether there are any objectionable points which require serious consideration, and anything else bearing on the subject.

The motion of Mr. Waitt, as amended by Mr. Barr, was passed, and the report of the Committee on Automatic Couplers taken up. The committee stated that it had not yet finished its investigations and asked to be continued for another year, which it was voted to do. The next report in order was that on Passenger Car Ends and Platforms.

Passenger Car Ends and Platforms.

The committee stated that it had investigated the question pretty carefully, and had found that so many changes were now in process of evolution among the different railway companies that it was inadvisable to recommend any standards at the present time. The committee therefore asked to be continued for another year, by which time it hoped to be able to present something definite.

In connection with the report, Mr. F. D. Adams (B. & A.), one of the members of the committee, presented some objections to certain points in the report. He urged that the present tendency in some instances to load the platforms of passenger cars down by heavy iron plates and braces was unnecessary, and especially objected to certain of the U. S. Government plans for postal cars, which placed the heater and toilet fixtures on the platforms and simply fenced in with a sort of vestibule.

The next report was that of the Committee on Coal Car Sides.

Coal Car Sides.

This committee was appointed to consider the best methods of staying the sides of 60,000-lb. coal cars with high sides. The method which the committee considered the most economical and efficient was to use a transverse tie-rod protected by angle iron, as shown in Fig. 3. Where, however, this construction is prohibited on account of cars being used at times to carry lumber and other lading with which a cross member would interfere, the committee recommended extending two stakes on each side and near the middle of the car, below the sills and supporting them by castings having a bearing against the sides of the hopper bottoms, as shown in Fig. 4. It was recommended that the stakes be made as deep as practicable, and that they be placed closer together near the middle than toward the ends of the car; also, that stake pockets be put on with a little draw, so that they can be tightened to follow up the shrinkage of the stakes.

Mr. E. S. Mitchell (N. Y., L. E. & W.): A method of staying coal cars which, I think, is superior to either of those recommended, is to have truss rods extend up the sides to a point about 6 ins. below the top.

Mr. Samuel Higgins (Lehigh Valley): The committee received a number of blueprints from some of the most prominent roads in the West that have been using the method of supporting the stakes by running them down and butting them up against the cross-tie timbers, and who claim that has given good results; but this arrangement we learned was probably a patented device, and we therefore deviated from it and recommended that the castings be placed on the side of the hopper, I do not agree with Mr. Mitchell as to truss rods. If you place the truss rod high enough you are liable to interfere with the clearance. That would be the trouble on our road. We have got to resort to the transverse rod.

Mr. E. W. Grieves (B. & O.): The construction shown here would work all right for the hopper of the gondola car, but not for an ordinary coal car, as known in the West. After we had about 5,000 cars built with the two center stakes above the cross-tie timbers, and extending over the tie timbers, we heard that this method was infringement of a patent, but subsequently we learned that it had been used by some road in the Northwest before the date of the patent. We are now using this construction when we alter our old cars; it holds up the sides and prevents them from bulging out. Our car sides are from 36 to 40 ins. high and are 34 ft. long. We have had good results from that practice.

Mr. W. S. Morris (Ches. & Ohio.): We use on our line 4,000 hopper-bottom cars, and our latest cars have sides 60 ins. high. We used the side truss for a good many years. We found that it was not what it should be, and we have adopted the transverse rod, which answers the purpose admirably.

Mr. A. E. Mitchell (N. Y., L. E. & W.): We had a good many cars where the side boards overlapped the end boards. We changed our construction as the cars went into the shop, so that the end boards overlapped the side boards, and then put the corner castings in so that the projection went through the end board. Since this change we have had no springing whatever of the end boards. We have a car that has been running two years with sides 50 ins. high and 34 ft. long, and with a side truss. I saw the car the other day and the sides are absolutely straight. The car has made 8,000 loaded miles and 8,000 empty miles.

Mr. E. W. Grieves (B. & O.): We have cars 60 ins. high, with the stakes extending down over the tie timbers; but they are only 24 ft. 9 ins. long and 8 ft. wide, so that we do not have any trouble at all in that length. I agree with what Mr. Morris has said in regard to the side truss rods. What we call the "pot hopper" is the best coal car of the kind that was ever built; that is, for light power and where they run in trains exclusively by themselves. When we had engines of light capacity and these cars carried from 26,000 lbs. to 40,000 lbs., we got good results. The only trouble was the action of the coal on the iron; it would eat it out in a short time. The Baltimore & Ohio has done a great coal business in these cars.

Mr. R. P. C. Sanderson (Norf. & Wn.): The Norfolk & Western R. R. used the side truss rods a long while on deep hoppers and found them unsatisfactory. Empty the cars would look all right, but loaded they would bulge. We found it impracticable to keep the side truss in proper shape. We now use on all deep hopper cars one or two cross braces made of oak and strapped on the top with iron bars.

This closed the discussion on all of the regular committee reports, and the convention proceeded to the election of officers for the ensuing year. The following officers were elected: President, John S. Lentz; First Vice-President, S. A. Crone; Second Vice-President, E. D. Bronner; Third Vice-President, J. C. Barber; Treasurer, G. W. Demerest. The three new members elected to the Executive Committee were R. H. Soule, H. S. Hayward, and A. E. Mitchell.

At the close an expression of the members on places for holding the convention of 1896 was called for. The places named were: Niagara Falls, N. Y.; Old Point Comfort, Va.; Chicago, Ill.; Saratoga, N. Y., and Atlantic City, N. J.

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PERSONALS.

Mr. Wm. Newman, Assoc. M. Can. Soc. C. E., has been appointed City Engineer of Windsor, Ont.

Mr. John Roach has been appointed Roadmaster of the Cleveland, Akron & Columbus R. R., with office at Columbus, O.

Mr. R. C. Barnard has been appointed Assistant Engineer of the Chicago Division of the Pennsylvania Lines, with office at Logansport, Ind.

Mr. W. H. Truesdale, Third Vice-President and General Manager of the Chicago, Rock Island & Pacific Ry., died at Rock Island, Ill., June 9, at the age of 72.

Mr. Frederick E. Sommers, Principal Assistant Engineer of the Chicago & Eastern Illinois R. R., was run over by a train and killed June 7 at Chicago Heights, Ill.

Mr. Albert V. Bensen and Mr. Albert Rathbone have been appointed members of the Board of Water Commissioners of Albany, N. Y., for terms of two and seven years.

Mr. B. Burwell, Jr., Chief Engineer of the Florida Central & Peninsular R. R., has been appointed also Superintendent of Bridges and Buildings, vice Mr. C. E. Martin.

Mr. Weddell has been elected City Engineer of Mansfield, O., vice Mr. Laird. He was formerly Assistant City Engineer, and was formerly surveyor of Ashland County, O.

Mr. B. E. Wellendorf, of St. Mary's, Pa., has been appointed Chief Engineer and Superintendent of the Buffalo & St. Mary's R. R., now under construction in Pennsylvania.

Mr. Clarence M. Mendenhall has been appointed Superintendent of Motive Power of the Philadelphia, Wilmington & Baltimore R. R., vice Mr. R. E. Marshall, transferred to the position of Division Superintendent of the Pennsylvania R. R., at Altoona, Pa.

Mr. Edwin E. Slick has been appointed Chief Engineer of the Edgar Thomson Steel Works, of the Carnegie Steel Co., Pittsburg, Pa., including the blast furnaces at Braddock, Pa. He succeeds Mr. Mercador, who has resigned to take charge of a large government steel plant in Austria.

Mr. Johns Hopkins, President of the Hestonville, Mantua & Fairmount Electric Ry., of Philadelphia, and Vice-President of the Huntington & Broad Top R. R., died at Philadelphia, Pa., recently, at the age of 37. He was a cousin of the founder of the Johns Hopkins University, at Baltimore, Md.

Mr. M. R. Sherrerd, Assoc. M. Am. Soc. C. E., who has been City Engineer of Troy, N. Y., for the last two years, has accepted the position as Engineer of the Board of Works of Newark, N. J., with immediate charge of the Water-Works Department. Mr. Sherrerd will remove to Newark July 1.

Mr. E. F. Brooks, Division Superintendent of the Philadelphia, Wilmington & Baltimore R. R., at Wilmington, Del., has been appointed Superintendent of the New York Division of the Pennsylvania R. R., with office at Jersey City, N. J., vice Mr. J. Crawford, on leave on account of sickness. Mr. William N. Barnard will succeed Mr. Brooks.

Prof. Daniel Kirkwood, late Professor of Mathematics in the Indiana State University, died at Riverside, Cal., June 11. He was born in Bladensburg, Md., in 1814. In 1851 he became Professor of Mathematics at Delaware College, and in 1856 accepted the same position in the Indiana State University, resigning in 1886. He was well known as an astronomer.

Mr. W. A. Drake has been appointed Chief Engineer of the Santa Fe, Prescott & Phoenix Ry., with headquarters at Prescott, Ariz. He will have charge of the Engineering Department, as also the Department of Track, Bridges & Buildings, and Water Service, reporting to the President and General Manager, Mr. F. M. Murphy.

Mr. A. M. Kinsman, who has been connected with the engineering department of the Illinois Central R. R. for the past 16 years as Assistant Engineer and Superintendent of Construction, has resigned to accept the position of Chief Engineer of the Wisconsin & Michigan and the Merrill, Antigo & Eastern railways. His headquarters will be at Menominee, Mich.

Mr. John Birkinbine, Civil and Mechanical Engineer, and late President of the Engineers' Club of Philadelphia, has been appointed to the Civil Service Board of that city to succeed Mr. John C. Trautwine, Jr., lately made Chief of the Water Bureau of Philadelphia. This board will, next week, examine applicants for the position of Chief of the Bureau of Highways.

Mr. A. V. Sims has been elected Professor of Civil Engineering of the State University of Iowa, Iowa City, Ia., and will assume the duties of the position at the beginning of the fall term. Mr. Sims was graduated from the University of Pennsylvania, taking a special course in civil engineering, and has filled the position of Chief Engineer with the following companies successively: The New England Terminal Co., the Atlantic & Danville R. R. Co., the Danville & East Tennessee R. R. Co., the Virginia & Kentucky Ry. Co., and the Utah, Nevada & California R. R. Co.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
June 20. Secy., D. Carhart, Carnegie Library Building, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
June 20. Secy., J. F. Wilson, Odd Fellows' Temple.
INDIANAPOLIS ENGINEERING CLUB.
June 22. Secy., C. C. Brown, City Engineer.
WISCONSIN POLYTECHNIC SOCIETY.
June 25. Secy., W. K. Means, Loan & Trust Building, Milwaukee.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
June 25 to 28. Annual Convention at Detroit, Mich., F. R. Hutton, Secy., 12 W. 31st St., New York city.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
June 25 to 28. At Niagara Falls, N. Y. Secy., R. W. Pope, 26 Cortlandt St., N. Y.
INTERNATIONAL RAILWAY CONGRESS.
June 26 to July 10. At London, England. Secy., F. Weissenbruch, Brussels, Belgium. Secy. of English Branch, W. M. Acworth, London, England.
ENGINEERING ASSOCIATION OF THE SOUTH.
June 27. Secy., H. D. Ruhm, Nashville, Tenn.
COLUMBIAN ENGINEERING SOCIETY.
July 2. Secy., W. F. Hart, University Building, 15th and H Sts. N. W., Washington, D. C.
WESTERN SOCIETY OF ENGINEERS.
July 3. Secy., Chas. J. Roney, 1736 Monadnock Block, Chicago.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
July 9. Secy., F. A. Coburn, Case Library Building.
MONTANA SOCIETY OF CIVIL ENGINEERS.
July 13. Secy., Forrest J. Smith, Denver Block, Helena, Mont.
ENGINEERS' CLUB OF MINNEAPOLIS.
July 15. Secy., E. Nexson, Kasota Block.
AMER. ASS'N FOR THE ADVANCEMENT OF SCIENCE.
Aug. 28 to Sept. 7. At Springfield, Mass. Secy., F. W. Putnam, Salem, Mass. Local Secy., Wm. A. Webster, Springfield, Mass.

CIVIL ENGINEERS' CLUB OF CLEVELAND.—At the meeting on June 11 a paper was read by Mr. Frank Aborn on "Some Facts Concerning Drawing for Engineers," setting forth the importance of drawing as a means of communicating information, and also the advantages of skill in freehand drawing.

F. A. Coburn, Secy.

ENGINEERS' CLUB OF CINCINNATI.—At the April meeting Mr. G. Bouscaren read a paper on "A Pure Water Supply for Cincinnati," in which he favored the purification of the Ohio River water for that purpose by the system of sand filtration. At the May meeting Mr. W. M. Venable read a paper on "Long Distance Transmission of Energy by Electricity," and a permanent standing committee on ship canal from the Ohio River to the Lakes was appointed.

J. F. Wilson, Secy.

THE WESTERN FOUNDRYMEN'S ASSOCIATION.—At the last annual meeting of this Association, held this month in Chicago, it was decided to incorporate it under the laws of the state of Illinois, and this is to be done at once. The Association is in its third year, and the success attending its efforts so far encourage its members to extend the field of its usefulness. The purposes of the Association are purely technical; in no way connected with questions of trades, prices or wages. It is intended for the interchange of ideas on practical experience in founding; for considering the application of chemistry to the business of founding; new methods of molding; the handling of finished, unfinished and raw products, etc. The initiation fee is $5 and the annual dues $10, and it is proposed to publish for the benefit of members such technical papers as are presented to and accepted by the Association. Annual meetings will be held at other points than Chicago as the membership grows. The present President is Mr. J. M. Sweeny, and all further information can be obtained by addressing Mr. S. T. Johnson, Secretary, 1522 Monadnock Building, Chicago, Ill.

SCHENECTADY TECHNICAL SOCIETY.—At a meeting held June 17 a paper on "Searchlights" was given by Mr. Gustave Faure, chief of the searchlight department of the General Electric Co., at Schenectady, N. Y. He described the methods of testing the uniformity of the light cast, the lenses used in searchlights, the positions and management of the carbons, the mirrors of the past and present and a general description of the uses made of searchlights upon the vessels of the various navies of the world, and especially of those used in the American navy, they having been constructed and furnished under Mr. Faure's direction.

NEW PUBLICATIONS.

MISSISSIPPI AS IT IS. A Handbook of Facts for Immigrants. Prepared by S. M. Tracy, Director of the State Experiment Station, Agricultural College, Jackson, Miss. Paper; 8vo; pp. 138; illustrated; folding map.

This book is intended to present the agricultural and manufacturing resources of Mississippi to persons in other parts of the country who contemplate moving to the South. The state has an area of 29,958,400 acres, of which 17,572,547 acres were occupied by 144,318 farms in 1890, at which time the population was 1,289,600. There are no mineral resources of importance, and the principal industries are agricultural.

REPORT OF THE BOARD OF RAILROAD COMMISSIONERS OF MASSACHUSETTS. Twenty-sixth Annual Report, for the year ending June 30, 1894. Published by the Board. W. A. Crafts, Secy., Boston, Mass. Cloth; 8vo; pp. 947.

This is the complete report, with detailed returns from the railway companies, these returns occupying 588 pages of the volume. There are 2,118 miles of main line and branches, an apparent reduction of 1.37 miles, which is due to remeasurement and improved alinement. A considerable amount of additional side track has been laid. The average cost per mile of the standard gage roads is $76,216 for construction and $9,388 for equipment. There is a report on the railway bridges by Mr. George F. Swain, bridge engineer to the board, and a summary of railway accidents, prepared by Mr. W. A. Crafts, clerk to the board. There were 15 train accidents, in which 9 passengers, 7 employees and 2 trespassers were killed and 49 persons and 26 employees were injured. This includes the fall of the Chester bridge on the Boston & Albany R. R. (Eng. News, Sept. 7, 1893). Out of a total of 42,150 freight cars on five roads, 14,543, or 34.5% (an increase of 10.1% over 1893), are equipped with automatic couplers. The six leading roads have 1,926 locomotives, of which 1,398, or 72.7%, are equipped with driving-wheel brakes. The same roads, with 39,826 freight cars, have 6,078 cars, or 15.3%, equipped with automatic train brakes. Under an act of 1894, three railway inspectors have been appointed. There are 68 street railway companies, with a total of 928.84 miles of railway, of which 103.87 are operated by horses and 824.97 by electricity.

TRADE PUBLICATIONS.

WATER TUBE BOILER.—L. M. Moyes, Philadelphia, Pa. 8vo; pp. 8.

This catalogue describes the Combine water tube boiler described and illustrated in our issue of May 23.

METAL SAWING MACHINES.—The Q. & C. Co., Chicago, Ill. Paper, 7 × 10 ins.; pp. 32; illustrated.

This pamphlet shows different forms of shop saws, the Bryant portable rail saw and stationary shop saws; saw grinding machines, etc.

STONE.—Avondale Marble Co., Avondale, Pa. Paper, 7¼ × 4½ ins.; pp. 12.

This pamphlet gives particulars of the analyses and strength of stone from the company's Echo quarry at Baker Station, Pa. The tests show an average crushing strength of about 18,000 lbs. per sq. in. The gray stone from this quarry is highly recommended for heavy masonry work.

THE PELTON WATER WHEEL, for Operating Riedler Pumps and Air Compressors, Dynamos, Hoisting and Crushing Machinery, Water Power Plants, Mines and Mills. Fraser & Chalmers, Chicago, Ill. 8vo; pamph.; pp. 61; illustrated.

This catalogue is designed primarily to show the application of the well-known Pelton water wheel to the operation of a large variety of mill and mining machinery, which is usually operated by steam engines. In connection with these special applications, there is also a large amount of general information relating to the setting and operation of Pelton wheels, and several tables showing the efficiency of various size wheels, from 6 ins. to 6 ft., under heads varying from 20 ft. to 1,000 ft. Altogether there is much information regarding this well-known water wheel which will be found useful by engineers.

Catalogues Wanted.

The Engineers' Club of Columbus, O., writes us that it is desirous of forming a catalogue library, and will be pleased to receive all trade publications. Address L. H. Goddard, Librarian, 12½ North High St., Columbus, O.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
June 21.	Water-works system, Elmwood, Ill. Advertised, Eng. News, May 23.		May 23
June 21.	Bridge superstructure, Buffalo, N. Y.		May 30
June 21.	Iron bridge, Cape Girardeau, Mo.		May 30
June 21.	Sewer, Cincinnati, O.		May 30
June 21.	Pipe sewers, etc., Rochester, N. Y.		June 13
June 21.	Paving, etc., Pittsburg, Pa.		June 13
June 21.	Pipe sewers, Pittsburg, Pa.		June 13
June 21.	Pig lead (100 tons), Buffalo, N. Y.		June 13
June 21.	Sewer, North Elba, N. Y.		June 13
June 21.	Bridge work, Easton, Pa. Advertised, Eng. News, June 13.		June 13
June 21.	Pipe sewers, Omaha, Neb.		June 13
June 21.	Wharf and jetty work, Tompkinsville,		June 20
June 21.	Brick paving, Adrian, Mich.		June 20
June 21.	Street cleaning, etc., Camden, N. J.		June 20
June 22.	Road improvement, Cincinnati, O.		June 6
June 22.	Sewers (28,120 ft.), Ithaca, N. Y. Advertised, Eng. News, June 6 and 13.		June 13
June 22.	Brick paving, Wilkinsburg, Pa. Advertised, Eng. News, June 13.		June 13
June 22.	Bridge, Cincinnati, O.		June 13
June 22.	Asphalt paving, Indianapolis, Ind.		June 13
June 22.	Hospital improvements, Brooklyn, N. Y.		June 20
June 22.	Riprap stone, Tompkinsville, N. Y. Advertised, Eng. News, June 20.		June 20
June 22.	Wharf and jetty work, Tompkinsville.		June 20
June 22.	Firebox boilers, Boston, Mass. Advertised, Eng. News, June 20.		June 20
June 24.	Court house plans, Denton, Tex.		May 30
June 24.	Garbage disposal, Washington, D. C.		May 30
June 24.	Iron piles, San Francisco, Cal.		June 6
June 24.	Paving, Piqua, O.		June 6
June 24.	Sewers, Binghamton, N. Y.		June 13
June 24.	Fire engine house, Brooklyn, N. Y.		June 13
June 24.	Water-works system, Earlville, Ill.		June 13
June 24.	Armory bldg. impvts, Brooklyn, N. Y.		June 20
June 24.	Sewers, New Castle, Pa.		June 20
June 24.	Sewer bonds ($50,000), Melrose, Mass.		June 20
June 24.	Sewer bonds ($75,000), Natick, Mass.		June 20
June 24.	Street sweeper, Marinette, Wis.		June 20
June 25.	Water-works system, Wapakoneta, O. Advertised, Eng. News, June 6 and 13.		June 6
June 25.	Pipe sewers, Buffalo, N. Y.		June 13
June 25.	Paving, Williamsport, Pa. Advertised, Eng. News, June 13 and 20.		June 13
June 25.	Heating, etc., at Charleston, S. C.		June 13
June 25.	Water-works system, Perrysville, O. Advertised, Eng. News, June 13.		June 13
June 25.	Brick paving, Hammond, Ind.		June 13
June 25.	Brick sewers (4,700 ft.), Hammond, Ind.		June 13
June 25.	Water-works system, Goliad, Tex.		June 13
June 25.	Railway (17¾ miles), Tilsonburg, Ont. Advertised, Eng. News, June 20.		June 20
June 25.	Steel or iron bridge, Trenton, N. J.		June 20
June 25.	Bridge, Staunton, Ill.		June 20
June 25.	School bldg. work, Philadelphia, Pa.		June 20
June 25.	Road, Boston, Mass.		June 20
June 25.	Asphalt paving, Brooklyn, N. Y.		June 20
June 25.	Paving, Philadelphia, Pa.		June 20
June 25.	Buildings, Galt, Ont.		June 20
June 25.	Brick sewers, Iowa City, Ia.		June 20
June 26.	Court house and jail, Swainsboro, Ga.		May 16
June 26.	Street r'y. franchise, Los Angeles, Cal.		June 6
June 26.	Macadamizing at Fort Crook, Neb.		June 6
June 26.	Reservoir, etc., New Bedford, Mass. Advertised, Eng. News, June 13.		June 13
June 26.	Lighthouse work, Round Island, Mich.		June 13
June 26.	Water-wks system, Stewartville, Minn.		June 13
June 26.	Cast iron pipe, Brooklyn, N. Y. Advertised, Eng. News, June 20.		June 20
June 26.	Car house, Boston, Mass.		June 20
June 26.	Paving, Buffalo, N. Y.		June 20
June 26.	Bridge and masonry, Oakland, Ill.		June 20
June 27.	Jetty work, Montgomery, Ala. Advertised, Eng. News, May 16 to June 6.		May 16
June 27.	Sewer materials, Brunswick, Me. Advertised, Eng. News, June 20.		June 20
June 27.	Reformatory building, Elmville, N. Y.		June 20
June 27.	Sewers (20,000 ft.), Newark, N. J.		June 20
June 27.	Pipe sewers, Brunswick, Me. Advertised, Eng. News, June 20.		June 20
June 27.	Water-works system, Monaca, Pa.		June 20
June 28.	Building, Faribault, Minn.		June 6
June 28.	Hire of dredge, New Orleans, La.		June 6
June 28.	Pumping machinery, San Francisco, Cal.		June 13
June 28.	Pumping engines, Asbury Park, N. J. Advertised, Eng. News, June 20 and 28.		June 20
June 28.	Boilers and stack, Asbury Park, N. J. Advertised, Eng. News, June 20 and 28.		June 20
June 28.	Brick paving, St. Louis, Mo.		June 20
June 28.	Stand-pipe, Maywood, Ill. Advertised, Eng. News, June 20.		June 20
June 28.	Dredging at Brooklyn navy yard.		June 20
June 29.	Wooden bridge, Cape Girardeau, Mo.		June 6
June 29.	Pipe sewers (5,430 ft.), Ithaca, N. Y.		June 20
June 29.	Railway (20 miles), Hamilton, Ont. Advertised, Eng. News, June 20.		June 20
June 29.	Iron work, etc., Washington, D. C.		June 20
June 29.	Water meters, Toronto, Ont.		June 20
June 30.	Jail, Wilkes Barre, Pa.		June 13
July 1.	Water-works system, Deckertown, N. J. Advertised, Eng. News, May 30 to June 13.		May 30
July 1.	Water-works system, Cullman, Ala.		May 30
July 1.	Crib dike, Wilmington, Del.		June 6
July 1.	Water supply, Jersey City, N. J.		June 6
July 1.	Road construction, Bristol, Me.		June 6
July 1.	Sewers, (9½ miles), Grinnell, Ia. Advertised, Eng. News, June 13 to 27.		June 13
July 1.	Water-wks. system, Elkhorn, Wis. Advertised, Eng. News, June 20.		June 20
July 1.	Water bonds ($25,000), Montgomery, N.Y.		June 20
July 1.	Sewers, Winnetka, Ill. Advertised, Eng. News, June 20.		June 20
July 1.	Resurfacing rds (7½ miles), Paterson, N.J.		June 20
July 1.	Stone sidewalks, Irvington, N. J.		June 20
July 1.	Bridge, Albany, N. Y.		June 20
July 1.	Lead pipe, Syracuse, N. Y. Advertised, Eng. News, June 20.		June 20
July 1.	Brick church, Columbus, O.		June 20
July 1.	Grading, Darby, Pa.		June 20
July 1.	Sewers, Darby, Pa.		June 20
July 1.	Court house, Winfield, W. Va.		June 20
July 1.	Bridge, Bronson, Fla.		June 20
July 1.	Sewers (1,800 ft), Dolgeville, N. Y. Advertised, Eng. News, June 20.		June 20
July 1.	Heating and power plant, Waupaca, Wis.		June 20
July 1.	Water-works system, Memphis, Mo. Advertised, Eng. News, June 20.		June 20
July 2.	Brick paving, Van Wert, O.		May 30
July 2.	Water-wks franchise, Greenville, Miss.		May 30
July 2.	Garbage removal, Harrison, N. J.		June 13
July 2.	Water bonds ($1,000), Fort Clinton, O.		June 13
July 2.	Dredging, Raleigh, Cal.		June 13
July 2.	Water-works system, Alton, N. Y.		June 20
July 2.	Street improvements, Trenton, N. J.		June 20
July 2.	Asphalt paving, Buffalo, N. Y.		June 20
July 3.	Bridges, Colusa, Cal.		Apr. 15
July 3.	Electric railway sale, Beatrice, Neb.		June 13
July 3.	Paving materials, Montreal, Que.		June 20
July 3.	School buildings (2), Madison, Ga.		June 20
July 3.	Laying water pipe, Yonkers, N. Y.		June 20
July 4.	Highway bridge, Hempstead, Tex.		June 20
July 5.	Stone culvert, Columbus, O.		June 13
July 5.	Sewers, Mattoon, Ill.		June 13
July 5.	Brick paving, Mattoon, Ill.		June 13
July 5.	Water-wks system, Cornwall-on-Hudson. Advertised, Eng. News, June 13 to July 4.		June 13
July 6.	Water-wks system, Rockville Center, N.Y. Advertised, Eng. News, June 20.		June 20
July 6.	Driving piles, Sioux City, Ia.		June 20
July 6.	Overflow sewer, Boston, Mass.		June 20
July 6.	Jail cells, Auburn, Cal.		May 16
July 6.	Brick arch, Mansfield, O.		June 20
July 8.	Courthouse, Baltimore, Md. Advertised, Eng. News, May 9 to 25.		May 9
July 8.	Buildings, Lafayette, Ind.		June 13
July 8.	Macadamizing, Stapleton, N. Y. Advertised, Eng. News, June 20 to July 4.		June 20
July 8.	School building, Cheney, Wash.		June 20
July 8.	Smoke preventing device, Cleveland, O.		June 20
July 8.	Plate girders, Syracuse, N. Y. Advertised, Eng. News, June 20.		June 20
July 8.	Sewers, East Orange, N. J. Advertised, Eng. News, June 20 to July 4.		June 20
July 9.	Steel water tank, Cincinnati, O. Advertised, Eng. News, June 20 and 27.		June 13
July 9.	Water-works system, Red Hook, N. Y.		June 20
July 10.	Reservoir, New York, N. Y. Advertised, Eng. News, June 20 to July 4.		June 20
July 11.	Electric light plant, Knoxville, Tenn. Advertised, Eng. News, June 20 to July 4.		June 20
July 11.	Street lighting, Knoxville, Tenn. Advertised, Eng. News, June 20 to July 4.		June 20
July 11.	Iron bridge, New Orleans, La.		June 20
July 15.	Brick pvg (13,165 sq.yds.), Waukegan, Ill. Advertised, Eng. News June 20 and 27.		June 20
July 15.	Electric lighting, Vicksburg, Miss.		June 20
July 17.	Dredging and removing ledge, Newport.		June 20
July 25.	Electric light plant, Bellefontaine, O.		June 20
July 20.	Water-works franchise, Perth, Ont.		June 20
Aug. 2.	Electric lighting, El Paso, Tex.		May 23
Aug. 5.	Plans for state capitol, St. Paul, Minn.		Apr. 25
Aug. 6.	Court house, Dublin, Ga.		June 20
Aug. 20.	Capitol building, Olympia, Wash.		June 20
Oct. 1.	Plans for art building, Philadelphia, Pa. Advertised, Eng. News, May 23 to June 27.		May 23

RAILWAYS.

East of Chicago.

BUFFALO & ST. MARYS.—The incorporation of this company was noted last week. The grading has been commenced, the steel rails purchased and the company expects to complete the road this season. Ch. Engr. and Supt., B. E. Weiendorf, St. Marys, Pa.

CENTRAL VERMONT.—This company is reported about to build a short branch to Pulp Mills, near Onteaugay, N. Y. Pres., E. C. Smith, St. Albans, Vt.

DEPEW & SOUTHWESTERN.—Incorporated in New York June 15 to build a steam railway from Depew to Blasdell, N. Y., 10 miles; capital stock, $500,000; incorporators, Wilson S. Bissell, A. D. Bissell, Martin Carey, W. B. Wright, Jr., and others, of Buffalo. W. S. Bissell has subscribed for 4,930 of the 5,000 shares.

DEPEW & TONAWANDA.—Incorporated in New York June 15 to build a railway from Depew to Tonawanda, N. Y., 10 miles. The capital stock and incorporators are the same as of the Depew & Southwestern, Wilson S. Bissell holding 4,930 of the shares.

ELKHART & WESTERN.—The Elkhart, Ind., "Review" states that information comes direct from a high official of the Elkhart & Western road that there is every assurance of the line being extended from Mishawaka to South Bend during the summer months, as authorized by the meeting of the directors held in 1894. Ch. Engr., A. F. Nims, Elkhart, Ind.

LONG ISLAND.—Press reports state that surveys are being made for a proposed extension to Port Washington, and that the residents of that place are raising $500 to pay the cost of the surveys; also that the yards at Great Neck are about to be enlarged and improvements made at that place.

MILAN, BIRMINGHAM & ELYRIA.—F. Burk, Secy., Birmingham, O., writes us that this railway is projected from Sandusky through Birmingham and South Amherst to Elyria, 28 miles. Efforts are being made to get the capital stock subscribed and surveys made. Only a temporary organization has yet been made. Pres., H. D. Olds, Birmingham, O.

NEW YORK, NEW HAVEN & HARTFORD.—The contract for eliminating four miles of grade crossings and four-tracking the Providence division of this road at Jamaica Plains, near Boston, has been divided into two parts. The work of one section has been awarded to H. H. Brown, of New York, at $640,000, and the second to John O'Brien, of New York, at $700,000. The work to be done by these contractors will be chiefly masonry. Dwight & Daly, of Boston, were awarded the contract for eliminating grade crossings and other improvements in and about Brockton, at $325,000. The improvements in and near Norwalk, including a four-track steel bridge, have been awarded to the Pennsylvania Steel Co., of Steelton, Pa., at $152,000. C. M. Ingersoll, ex-Cy. Engr., New Haven, Conn., is in charge of these improvements.

PENNSYLVANIA.—New Jersey papers state that the construction has been commenced on a short line from Hanover Station through the pines to Manahawkin, N. J., 21 miles, which will shorten the time from Philadelphia to Beach Haven and other resorts on Long Beach fully half an hour.——The Altoona, Pa., "Mirror" states that work on the new railway from Bedford, Pa., to McKee's Gap has been commenced by Theodore Genish, contractor, of Lewiston, Me., and it is now confidently expected that the road will be completed this summer. Five miles of track has already been laid, and the last bridge is in course of construction. A route connecting with the Midland has been surveyed into the Somerset coal fields, and it will be a valuable feeder when both are completed.

PITTSBURG, MONONGAHELA & WHEELING.—W. G. Dacey, 40 Wall St., New York, is president of this company. The project was noted in our issue of last week.

RUMFORD FALLS & RANGELEY LAKES.—R. B. Straton, Ch. Engr., Rumford Falls, Me., writes us that the contract for extending this railway, as advertised in Engineering News, has been awarded to Nelson & Rehill, of Dunellen, N. J., the other bidders being Ward Bros., Kennebunk, Me.; McGraw & Malone, 124 Tremont St., Boston; McGregor Bros., Rumford Falls, Me.; J. P. Stanton, 61 Broadway, New York; Jas. Mitchell, Portland, Me.; W. B. Straug, Jr., & Co., 15 Wall St., New York.

TERMINAL RY. OF BUFFALO.—Incorporated in New York, according to press reports, to build a steam railway between Blasdell and Depew, 10 miles; capital stock, $500,000; incorporators, John M. Brinker, R. W. Jones, B. L. Sheldon, C. R. Riselay, and others, of Buffalo; H. L. Sprague, of New York, and others.

TILSONBURG, LAKE ERIE & PACIFIC.—Bids are asked until June 25 for the construction of 17¾ miles of this railway, which was noted in our issue of May 9. It will be standard gage. The grading will be light, and principally of sand; maximum grade, 1%. The work will require the construction of two large bridges across deep ravines. The advertisement asking for bids for the above work will be found in another column of this issue. Ch. Engr., R. F. Tate, Tilsonburg, Ont.; Vice-Pres., W. S. Law, Tilsonburg, Ont.; Treas., R. Jenkins, Toronto, Ont.

TORONTO, HAMILTON & BUFFALO.—Bids are asked until June 29 for constructing this railway from a connection with the Michigan Central at Welland, Ont., to Hamilton, Ont., a distance of about 40 miles, as stated in our advertising columns. E. B. Wingate, Ch. Engr.; Jas. N. Young, Gen. Man. the Dominion Const'n Co., Hamilton, Ont.

Southern.

ATLANTIC & DANVILLE.—It is reported that this company has decided to build a branch from Danville to Chase City, Va., for hauling granite from the quarries at that point. Ch. Engr., Chas. O. Haines, Norfolk, Va.

MARIENBAD SPRINGS.—This company is in the market for a dummy engine, about 44,000 lbs. on driver; summer coach, closed coach, a light flat car and 5½ miles of 40-lb. steel T-rails, with spikes, splice-joints and bolts, all complete. Address T. B. Crawford, Winston, N. C.

NEW ORLEANS & NORTHWESTERN.—It is reported probable that this railway will be extended from Bastrop, La., to New Orleans, a distance of 225 miles. Pres., Chas. Hyde, Plainfield, N. J.

NORTH STATE LUMBER CO.—This company, of Goldsboro, N. C., has made surveys and secured most of the right of way for a standard gage road about 50 miles long through tracts of timber land it owns in Dublin and adjoining counties to a point on the Cape Fear & Yadkin road near Fayetteville, N. C. Pres., W. H. Bosley, of Baltimore, Md.

OHIO RIVER & CHARLESTON.—Press reports state that engineers are at work between Marion, N. C., and Johnson City, Tenn., with a view to the early construction of the line between those cities. This was formerly the Charleston, Cincinnati & Chicago road, and is usually referred to as the Three C's. Ch. Engr. and Supt., A. N. Molesworth, Johnson City, Tenn.

OLIVER SPRINGS CO.—Surveys have been made by the Oliver Springs Co., of Oliver Springs, Tenn., for about 20 miles of railway to connect its coal fields with the Southern Ry. A. B. Marshall, Frank Weddell and others, of Cleveland, O., are interested.

PITTSTON HARD ROCK PHOSPHATE CO.—Col. Pitts, of this company, of Pittston, Fla., is quoted as stating that the company is building a railway from Fort White to Old Town, on the Suwannee River, of which five miles are completed. The project includes a branch to Levyville.

RED SPRINGS AND BOWMORE.—The construction of this railway has been commenced from Bowmore into Richmond county, N. C. It will be 20 miles long and will be operated as a branch of the Cape Fear & Yadkin Valley. J. L. McMillan, Red Springs, N. C., is interested.

SOUTHERN.—A correspondent writing us from Raleigh, N. C., says that the deal which is understood to have been effected between the Southern Railway and the Atlantic Coast Line will put Raleigh on another through trunk line via the Southern. It is understood there that, by the new arrangement the Southern will run their trains over the Wilmington & Weldon from Selma, N. C., to Contentnea, to Rocky Mount, to Tarboro, N. C., and from Tarboro to Norfolk over the Norfolk & Carolina. The Southern's main through line at present is from Washington, Richmond and Danville via Greensboro and Charlotte, N. C., south to Atlanta, etc. Under the new arrangement the Southern through trains from Norfolk will go via the Norfolk & Carolina (Atlantic Coast Line) to Tarboro, thence to Selma, on the North Carolina R. R. (which is already a division of the Southern system) via Raleigh to Greensboro, N. C., where it will tap the old main line. It is also understood that by reason of this arrangement the Albemarle & Raleigh, which now has its terminus at Springhope, N. C., will be completed to Raleigh, as the completion of the road to that point would make it a paying road under the new arrangements. It is also understood that the Southern has purchased the warehouses of Vaughan, Barnes & Co. and Farrar & Co., and other river front property in Norfolk, for which about $500,000 will be paid.

TITUSVILLE CANAVERAL & PENINSULAR.—This company proposes to build a railway from Titusville to Cape Canaveral, Fla., on the coast, a distance of about 60 miles. Pres., Howell Titus, Titusville, Fla.

Northwest.

CALUMET & BLUE ISLAND.—Mayor Swift, of Chicago, has vetoed the ordinance granting this company right of way for an extension along the lake front at South Chicago.

DE KALB & GREAT WESTERN.—Raymond Du Puy, Pres. and Ch. Engr., 820 Temple Bldg., Chicago, writes us that this railway is about graded, and that the tracklaying will be commenced at once. The line extends from Sycamore to De Kalb, Ill., six miles. Foley Bros. & Guthrie, of St. Paul, are the contractors.

DES MOINES & KANSAS CITY.—Des Moines, Ia., papers state that plans are about completed for changing

this road to standard gage and extending the line from Cainsville to Trenton. Gen. Man., J. C. Newton, Holyoke, Mass.

MISSISSIPPI, COLESBURG & MANCHESTER.—W. C. Kirchbeck, Secy., Colesburg, Ia., writes us that surveys will be made this month for this railway, which is projected from Turkey River Station to Colesburg, and thence to Manchester, 40 miles. The capital for the construction is not all subscribed, and no contracts will be awarded at present. The road will be built without any debt. Ch. Engr., Max Lindeman, Epworth, Ia.; Pres., E. L. McNamee, Colesburg, Ia.

ST. LOUIS, PERRY & CHICAGO.—J.M. Piper, Pres., St. Louis, Mo., writes to the "Railway Age" that surveys have been made for this road from Grafton, Ill., northerly via Hardin, Pearl, Griggsville, Perry, Mount Sterling, Ashville and Littleton, to Macomb, Ill., 150 miles. The line will cross the Illinois River at Deer Plains, 8 miles west of Grafton, where a bridge will be built, and will run on the de of the riverwest be built,and will run on the west side of the river north through the counties of Calhoun, Pike, Brown, Schuyler and McDonough. The contract has been let to Moulten & Keen, of St. Louis, and it is expected to begin grading within 30 days. Low grades and light curves; 60-lb. steel rails. Vice-Pres. and Gen. Man., Wm. Atchison; Ch. Engr., C. G. Folger, both of St. Louis. Headquarters of company, Perry, Ill.

TERRE HAUTE, SAYLOR SPRINGS & MOUNT VERNON.—Press reports state that contracts will soon be awarded for building this railway from Mount Vernon, Ill., to the Indiana state line. Horace C. Pugh, of Terre Haute, Ind., has been appointed general manager, with headquarters at Terre Haute.

WINNIPEG & HUDSON'S BAY.—Subcontracts on this railway will be awarded by Foley Bros. & Guthrie, of St. Paul, Minn., within a few days. We are informed that no subcontracts have yet been awarded by this firm.

Southwest.

MINEOLA & PITTSBURG.—This company has been organized at Mineola, Tex., with a capital stock of $100,000, of which $41,000 is subscribed, to build a railway about 41 miles in length. Pres., B. F. Reed; Secy., W. B. Teagarden; Treas., I. G. Bromberg.

MISSOURI, KANSAS & TEXAS.—R. M. Quigley & Co., of St. Louis, have been awarded the contract for the proposed extension from Windsor, Mo., to Holden, 42 miles. The work is to be completed within 100 days.

ST. JOSEPH & TOPEKA.—A press report states as follows: Owing to the cutting of the Missouri River on the east bank and the probability of preventing the use of the bridge leading to Atchison, Kan., it is proposed to build a railway on the Kansas side just west of St. Joseph, Mo., to Atchison. The old St. Joseph & Topeka road was built and operated between these two points, but when the Atchison bridge was built there was no longer any use for the road, as it lacked in paying its owners. There is little doubt the road will be rebuilt during the year.

ST. LOUIS, FENTON & SOUTHWESTERN.—Incorporated in Missouri June 7 to build and operate a railway from the city of St. Louis through the counties of St. Louis and Jefferson via Fenton to Morse's Mill, in Jefferson county, Mo., a total distance of about 35 miles; capital stock, $500,000; incorporators, E. J. Thurman, J. B. Clayton, W. D. Waters, J. H. Winer, E. W. Knott, M. E. Byrnes and J. L. Garber.

Rocky Mt. and Pacific

KASLO & SLOCUM.—This railway, which has recently been noted in these columns, extends from Kaslo, on the Kootenay Lake, northwardly to Sandow, or Cody Creek, about 30 miles. Foley Bros. & Guthrie, Gilfillan Block, St. Paul, Minn., are the contractors.

PLATEAU VALLEY.—Incorporated in Colorado to build a railway along the Grand River in Mesa and Grand counties, commencing at Grand Junction. Surveys have been made; capital stock, $250,000; incorporators, F. P. Ernest, Geo. W. Vallery and Fred S. Rockwell, Denver; P. T. Stevens, and Anson Adams, Jr., of Grand Junction, Colo.

STREET AND ELECTRIC RAILWAYS.

SKOWHEGAN, ME.—The contract for grading the first four miles of the Somerset Traction Co.'s road has been awarded to W. D. Smith & Co., of Bangor. Six miles more will be ready for contract a few weeks later. E. E. Greenwood, Engr.

MILFORD, MASS.—Arrangements are being made to construct an electric railway from this place to Medway. C. W. Shippee, of this city, is interested.

CORTLAND, N. Y.—The Cortland & Homer Traction Co. has petitioned for a franchise for its electric road. Pres., F. W. Higgins.

LOCKPORT, N. Y.—The construction of an electric railway to connect Buffalo, Lockport and Olcott is being considered by Charles Johnson, Pres. Lock City Electric R. R. Co.; F. H. Reed, of New York, and Wm. T. Tiers, of Philadelphia. The estimated cost of the road to Olcott, a distance of 12 miles, is $150,000.

STONY BROOK, N. Y.—It is proposed to construct the Cycloid Cross Island R. R. from Sayville to Crane's Neck Point at this place. Dr. L. C. D'Homergue and Andrew L. Murphy, of Brooklyn, and Israel G. Hawkins, are interested.

CHESTER, PA.—We are informed that the Prospect St. Ry. is about half graded. The road will be built from Lazaretto to Baltimore Pike, a little beyond Morton station, a distance of about six miles, 2½ miles of which is expected to be completed by July 4. Pres., Crosby M. Black, Chester.

LANGHORNE, PA.—Henry W. Watson, Pres. Newtown, Langhorne & Bristol Trolley St. Ry. Co., writes us that nearly all the right of way has been secured for the road from Newtown to Bristol by way of Langhorne, Langhorne Manor and Newportville, a distance of 10 miles. Enough capital has been secured to warrant the commencing of the construction. The contracts will be awarded as soon as the entire right of way has been secured and other details are completed.

BOONSBORO, MD.—Dr. A. Will Lakin writes us that the Boonsboro & South Mountain R. R. Co. has secured the right of way for its road from this place to Keedysville, a distance of three miles, where it will connect with a branch of the Baltimore & Ohio R. R. The town refused to indorse the bonds for half the capital stock, thereby defeating the project at present. Half the money is subscribed, the roadbed nearly completed, and the cross-ties laid. Pres., Robt. J. Shafer, of Boonsboro; Ch. Engr., Joseph Vandergriff, of Philadelphia.

NORFOLK, VA.—J. P. Andre Mottu, Pres., writes us that right of way has partly been secured, but no surveys have yet been made for the construction of the South Norfolk Electric R. R. Co.'s road between South Norfolk and Berkley, a distance of 3½ to 4 miles. The minimum amount of capital has been subscribed, but outside capital is wanted.

RICHMOND, VA.—The Richmond Conduit Co. has been granted permission to build its electric road on Broad St. Engr., L. H. Hyer, of Washington; Edmund Pendleton is representing the company.

PARKERSBURG, W. VA.—We are informed that V. A. Dunbar & Son, of Parkersburg, have made surveys for the Parkersburg Traction Co.'s electric road in this city and the suburbs, a distance of 10 miles. It is claimed that the capital for the construction has been secured, but it is not known when contracts for the construction will be awarded. Pres., W. R. Hurd, 257 Broadway, New York.

SPARTANBURG, S. C.—We are informed that Geo. O. Tenney, of Clifton, S. C., has been awarded the contract for building and equipping an electric railway at this place, to be 12 miles in length.

VICKSBURG, MISS.—The construction of an electric railway is being considered.

LOUISVILLE, KY.—It is proposed to construct an electric railway along the Bardstown Pike, from Louisville to Fairfield, by way of Fern Grove Creek, Fairmount, Mount Washington and High Grove. D. McKinney, of Fairfield, and John H. Ward, of Louisville, are interested. The following committee has been appointed to carry out the project: W. F. Carrithers, Lafe De Witt, J. G. Queen, W. P. Stallfiger, and J. C. Wright.

CHATTANOOGA, TENN.—It is reported that a new incline railway company has been organized, and that a considerable amount of the right of way has been secured and that the work will probably be begun at once. Pres., J. S. Crass; Secy. and Treas., Vernon S. Whiteside; Engr., Linn White.

WARREN, O.—Press reports state that the North Trumbull Rapid Transit Co. has applied to the county commissioners for a franchise to construct an electric railway from Farmdale, in Kinsman township, to Mesopotamia, a distance of 19 miles. At Mesopotamia the road is expected to connect with a Cleveland line. Both freight and passengers will be carried.

XENIA, O.—John B. Stevenson, G. A. McKay, A. G. Carpenter, R. R. Knowles and others are the incorporators of the Springfield, Clifton & Cedarville Electric Ry. Co., noted as incorporated in our issue of last week.

YOUNGSTOWN, O.—A. A. Anderson writes us that surveys have been made and right of way secured for the Mahoning Valley Electric Ry. Co.'s road to connect Youngstown, Girard and Niles, a distance of 10 miles. The capital for the construction has been obtained, and the contract awarded to Degnon & Co. The land along the route has been cleaned of timber, culverts are being put in, and the grading was to be begun June 18. Pres., C. F. Clapp, of Warren.

BATESVILLE, IND.—The Batesville & Oldenburg R. R. & Electric Co. has been incorporated to build a road three miles in length; capital stock, $50,000; directors, Kendall M. Hord and John A. Tindall, of Shelbyville; John Hilderbrand, of Batesville, and Augustus A. Harkman, of Oldenburg.

DETROIT, MICH.—The Citizens' Ry. Co. has been granted permission to extend its electric road.

LA CROSSE, WIS.—A press report states that Fred H. Pickles, of Winona, Minn., has been engaged as chief engineer for the construction of an electric railway from Neillsville to La Crosse, a distance of 90 miles, for which the surveys will be commenced at once.

OSHKOSH, WIS.—The Central Wisconsin Electric Ry. Co. has been granted an extension of its franchise. Pres., Geo. H. Ketcham; Secy., Frank M. Ohl, of Toledo, O.

SHEBOYGAN, WIS.—The Sheboygan Consolidated St. Car Co. has awarded C. E. Loss, of Chicago, the contract for constructing and equipping 11 miles of its electric road, the work to be completed in 60 days, according to reports.

KANSAS CITY, MO.—The Metropolitan St. Ry. Co. has petitioned for permission to extend its electric road on Wyoming St. Gen. Man., Walton Holmes.

ST. JOSEPH, MO.—The St. Joseph Traction & Lighting Co. has petitioned for permission to extend its electric road to St. George. The construction alone is estimated to cost $15,000. The railway may ultimately be extended to Lake Contrary. Gen. Supt., W. T. Van Brunt.

ST. LOUIS, MO.—The St. Louis, Fenton & Southwestern Ry. Co. has been incorporated to build an electric railway from St. Louis to Morse's Mill, Jefferson county, a distance of 35 miles; capital stock, $500,000; directors, E. J. Thurman, of Fenton; J. B. Clayton, of Kirkwood; Wm. D. Waters, of St. Louis; James H. Witner, of Morse's Mill, and Michael F. Byrne, of Byrnesville.

ATCHISON, KAN.—The Atchison Ry., Light & Power Co. has been incorporated with a capital stock of $200,000 by James W. Orr, R. B. Morris, E. C. Post, R. L. Pease and C. M. Rathburn, all of Atchison.

LITTLE ROCK, ARK.—The Boulevard St. Ry. Co. is to build an electric road 3½ miles in length. J. H. Healey, of Little Rock, desires to correspond with electric railway contractors in regard to building the road. W. S. McKain, E. W. Kimball and P. W. Crawford are interested.

HULL, QUE.—It is reported that Theophile Vian, of Ottawa, will soon begin the construction of an electric railway between Hull and Aylmer.

QUEBEC, QUE.—The council has granted a franchise to Mr. Beemer for an electric railway in this city, according to reports.

ELECTRIC LIGHT AND POWER.

CHICOPEE, MASS.—F. P. Cobb, Cy. Engr., informs us that the committee has been directed to secure plans and bids for the erection of an electric light plant. This work was noted last week as having been recommended.

COLUMBIA, ALA.—It is reported that the question of establishing an electric light plant is being considered. Geo. L. Campbell is interested.

CANTON, MISS.—B. Mass, Chn. Water Com., writes us that the city contemplates building an electric light plant in connection with water-works. H. W. Latimer, Cy. Clk.

VICKSBURG, MISS.—Bids are asked until July 15 for furnishing 81 arc, of 1,200 c. p., and 34 incandescent lights of 50 c. p. for three or five years. W. L. Trowbridge, Mayor.

KNOXVILLE, TENN.—Bids are asked until July 11 for lighting the city for five or ten years with 200 arc lights of 2,000 c. p., or with 800 to 1,000 gas lights of 18 to 20 c. p.; also for the erection of a municipal electric light plant, as stated in our advertising columns. Reps Jones, Chn. Bd. Pub. Wks.

BELLEFONTAINE, O.—Bids are asked until June 25 for constructing an electric light plant, according to plans prepared by E. P. Roberts & Co., of Cleveland. S. M. Stamats, Village Clk.

ILLIOPOLIS, ILL.—Ford & Metcalf have petitioned the town board for a franchise to erect an electric light plant, according to reports.

WENONA, ILL.—The council has voted to build a municipal electric light plant.

MILWAUKEE, WIS.—The Edison Illuminating Co., which is controlled by the Milwaukee St. Ry. Co., has awarded contracts for new engines, cables, conductors, etc., at an estimated cost of $75,000 to $100,000. The work is to be completed by Oct. 1.

WEST SALEM, WIS.—It is reported that Samuel McMillan is making arrangements for putting in an electric light plant.

AIKEN, MINN.—J. J. McDonald has purchased $10,000 of electric light bonds.

MANKATO, MINN.—An election is to be held July 9 to vote on the question of issuing $10,000 in bonds for an electric light plant.

WORTHINGTON, MINN.—It is reported that this village has voted to put in an electric plant, for which $15,000 in bonds will be issued.

FRESNO, CAL.—Press reports state that the directors of the San Joaquin Electric Co. have awarded the contract for building the big reservoir on the north fork of the San Joaquin River, by which it is expected that electricity for lighting and power purposes will be supplied to Fresno in the near future. The reservoir will cover eight acres, with an average depth of 10 ft.

RIVERSIDE, CAL.—This place has voted to issue bonds for an electric light plant.

NEW COMPANIES.—Bridgton & Harrison Electric Co., Bridgton, Me.; $10,000, with $300 paid in; Pres., Geo. P. Locke, Norway, Me.; Treas., C. A. Scribner, Bridgton.

Franklin Co., Pittsburg, Pa.; $1,000; to supply electric lights, heat and power; Treas., H. W. Mitchell, Pittsburg.

Chatham Electric Light, Heat & Power Co., Chatham, N. Y.; $10,000; John F. Farrell, Albany; H. M. Francis, J. O. Carr, Schenectady.

Allegheny Power Co., Pittsburg, Pa.; $1,000; to furnish electric lights, heat and power to Allegheny; Treas., H. W. Mitchell, Allegheny.

Penn Electric, Light, Heat & Power Co., Reading, Pa.; $100,000; John R. Bechtel, John Barbey, Wellington Bertolle, Charles N. Frame, Reading.

South American Light, Power & Traction Co., Beatrice, Neb.; $1,000,000, with $100 paid in; A. S. Paddock, Robt. S. Forbes, E. W. De Leon, F. H. Paddock.

Ceresco Mill & Hydraulic Co., Ceresco, Mich.; $40,000; to supply power from the Kalamazoo River; Pres., George Preston; Secy., Henry D. Hall; Treas., Chas H. Frisbie, all of Jackson, Mich.

Marion Water Co., Marion, O.; $250,000, with $400 paid in; to supply electric lights, water and gas; Pres., C. C. Chapman; Treas., C. J. Chapman, New York; Newman Earl, New York; C. E. Burke, Cleveland, O.; E. E. Pratt, Boston, Mass.

Central California Electric Co., incorporated in New Jersey, with principal place of business at Jersey City; $100,000, with $10,000 paid in; to construct plants, manufacture electrical machinery, etc.; Warner Van Norden, W. de La M. Van Norden, New York; H. T. Bronson, Rye, N. Y.; Edward C. Boardman, Garden City, N. Y.; Herman Dowd, Orange, N. J.

BRIDGES.

MANCHESTER, N. H.—E. K. Turner, Engr., of Boston, has recommended the committee to build a new five-arch stone bridge over the Merrimack River at Granite St. The bridge would be 80 ft. in width, and is estimated to cost $200,000. A temporary bridge could be built at an estimated cost of about $7,000.

CHICOPEE, MASS.—F. P. Cobb, Cy. Engr., writes us that the bridge over the Chicopee River at Chicopee Falls is to be built by the R. F. Hawkins Iron Works. The bridge is to be completed by Aug. 1, together with the canal bridge. The total cost of both will be about $26,800.

NEW BEDFORD, MASS.—The committee is reported about to award the contract for repairing the Coggeshall St. bridge to the Kings Bridge Co., of Cleveland, at about $6,000.

NEW HAVEN, CONN.—The Pennsylvania Steel Co., of Steelton, Pa., is reported to have been awarded the contract by the New York, New Haven & Hartford R. R. Co. for improvements near Norwalk, which includes a four-track steel bridge. The work will cost about $150,000.

ALBANY, N. Y.—At a meeting of the board of contract and apportionment, June 17, some changes were made in the general plans for the Northern Boulevard bridge and the work was ordered readvertised. Bids will be opened July 1. Horace Andrews, Cy. Engr.

ITHACA, N. Y.—The committee has voted to ask for bids for constructing a bridge at Quarry St. and Stewart Ave. C. W. Sullivan, Chn. Com.

LONG ISLAND CITY, N. Y.—The plans and specifications for a lift bridge over Newtown Creek, between Manhattan and Vernon Aves., were approved by the board of supervisors of Kings county June 17. The plans had already been approved by the supervisors of Queens county. John J. McLaughlin, Engr.

MIDDLETOWN, N. Y.—Plans have been prepared for a bridge over the tracks of the New York, Lake Erie & Western R. R. at Cornelia St. for the proposed extension of the Middletown & Goshen Traction Co.'s road to the state hospital. Plans have also been prepared for a bridge over the Erie tracks at Summit Ave. for the street railway.

ROCHESTER, N. Y.—The New York Central & Hudson River R. R. Co. is reported about to build new bridges at Kent, Smith, Oak and Orchard St. crossings in this city.

SYRACUSE, N. Y.—Bids are asked until July 8 for four plate girders, two 45 ft. long, one 65 ft. long and one 67 ft. long, as stated in our advertising columns. W. R. Hill, Ch. Engr. Water Bd.

RUTHERFORD, N. J.—It is reported that the Bergen county board of freeholders have voted to erect an iron bridge over the Passaic River at Rutherford, at an estimated cost of $26,000, half to be paid by Passaic county and half by Bergen county.

TRENTON, N. J.—Bids are asked until June 25 for building a steel or wrought iron bridge, with stone abutments and wing walls, over Stony Brook at Glenmore, Mercer county. Arch., H. E. Finch; A. L. Holcombe, Chn. Com.

WOODCLIFF, N. J.—Plans have been completed for two iron bridges ordered by the board of freeholders, both of which are to be completed within two months.

RICHMOND, VA.—It is reported that the Richmond Conduit Co. may build a steel bridge. Engr., L. H. Hyer, of Washington; Edmund Pendleton is interested.

BRONSON, FLA.—Bids are asked until July 1 for building a highway bridge near Cedar Key. S. Quincey, Chn. Com.

JACKSONVILLE, FLA.—At the last meeting of the commissioners of Duval county W. F. Coachman, Comr., Jacksonville, was directed by the board to correspond with bridge builders in regard to a new bridge across the St. John's River within the city limits.

VICKSBURG, MISS.—Bids are asked until July 2 for building an iron bridge over Big Black River at Messenger's Ferry and an iron bridge and a brick culvert near Hayne's Bluff. J. D. Laughlin, Clk. Bd. Supervisors, Warren County.

ABBEVILLE, LA.—W. W. Edwards, Chn. Com., writes us that the police jury of Vermilion parish proposes to build a steel swing bridge at this place, of 60 or 65 ft. clear opening. The plans for this bridge will probably be adopted at Abbeville on June 24, and the contract awarded June 28. Consult. Engr., P. H. Philbrick, of Lake Charles.

NEW ORLEANS, LA.—Bids are asked until July 11 for constructing an iron girder bridge at Fort St. Philip. Maj. James B. Quinn, U. S. Engr. Office.

MIDDLETOWN, O.—Plans have been prepared by the county surveyor for a new swing bridge on North Main St., work on which it is expected will be commenced at once.——Patrick Golden has been awarded the contract for the construction of a bridge near Lakeside.

YOUNGSTOWN, O.—The county commissioners are reported as favorably considering the project of constructing a high level bridge over the river at South Ave. It is reported that $30,000 has been raised, and that $10,000 more can be secured if necessary to aid in the construction.

GRAND RAPIDS, MICH.—Press reports state that a part of the Chicago & West Michigan bridge over the steamboat channel in the southern part of this city gave way June 15 and several persons were injured, one perhaps fatally. The railway company was having piles driven to strengthen the bridge, which is an approach to the main bridge over Grand River. A freight train was on the bridge, and its crew and about 25 spectators were on the railing and footpath when the latter gave way, letting the crowd into the channel, 20 ft. below.

SPRINGWELLS, MICH.—The township boards of Springwells and Ecorse have voted to advertise for bids for changing the Salisbury bridge near the salt wells to a lift or drawbridge.——The boards are considering the question of building a new iron swing bridge over the Rouge River on the River road. The committee appointed to secure estimates includes Geo. O. Fischer, of Springwells, and Edmund Drouillard, of Ecorse.

OAKLAND, ILL.—Bids are asked until June 26 for a 180-ft. highway bridge with about 300 yds. of squared stone masonry, 14-in. courses. For particulars address B. F. Parke, Hindsboro, Ill.

ROCK ISLAND, ILL.—Ralph Modjeska, of Chicago, is reported as about to prepare plans for reconstructing the Chicago, Rock Island & Pacific Ry. bridge at this place, at an estimated cost of $100,000.

STAUNTON, ILL.—Bids are asked by the commissioners of highways until June 25 for constructing the Becker bridge, four miles east of this place. Bids were opened June 4, but were rejected, according to reports.

SIOUX CITY, IA.—F. E. Cleaves, Cy. Clk., is quoted as stating that it has been decided to resume work on the construction of the Pacific Short Line bridge over the Missouri River between this city and Covington, Neb. Arrangements for the work are now being made.

JANESVILLE, WIS.—New plans have been prepared for repairing the Jackson St. bridge, about 1,100 ft. in length.

AITKIN, MINN.—Press reports state that Aitkin county voted June 11 to bond the county for the purpose of constructing roads and bridges. This will raise some $16,000, which ensures the bridging of the Mississippi River at Aitkin.

HEMPSTEAD, TEX.—Bids are asked until July 4 for building a bridge over the Brazos River about four miles from this city. T. B. McDade, Clk. County Court.

TORONTO, ONT.—Efforts are being made to have the Canadian Pacific Ry. Co. build a bridge over its tracks at York St.

BUILDINGS.

BOSTON, MASS.—Bids are asked until June 26 for the erection of a car house on Amory St., with steel frame and terra cotta walls. C. S. Sergeant, Gen. Man. West End St. Ry. Co.

ROXBURY, MASS.—John L. Faxon, of Boston, has prepared plans for a five-story brick and steel building at Washington and Warren Sts.

EAST WEYMOUTH, MASS.—It is stated that the Quincy & Boston St. Ry. Co. is to erect a brick and stone building on the Ezra Tirrell estate, 125 × 85 ft., which will be utilized as a car house, repair shop and supplementary power house.

BROOKLYN, N. Y.—Bids are asked until June 22 for making improvements in the naval hospital, which are estimated to cost about $44,000. J. R. Tryon, Surgeon-Gen. U. S. Navy.——Bids are asked until June 24 for alteration and improvement of the armory of the Third Battery, on Clermont Ave., near Myrtle Ave. Daniel Ryan, Supt. Construction.

BUFFALO, N. Y.—C. H. Williams has obtained permission from the bureau of building to build a three-story brick and stone dwelling at 672 Delaware Ave., to cost $70,000. Arch., George Cary.

ELLENVILLE, N. Y.—Bids are asked until June 27 for erecting a portion of the Eastern New York Reformatory at Napanock, Ulster county. Arch., John R. Thomas, 100 Broadway, New York; George Dyo, Secy. Bd. Comrs.

HORNELLSVILLE, N. Y.—The city has voted to issue $30,000 in bonds for a new city hall.

NEW YORK, N. Y.—Plans have been filed by the city for a five-story brick school building at St. Ann's Ave. and 147th St., to cost $190,000; by the Association of the Bar, 105 East 38th St., for a four-story brick clubroom and library on 44th and 43d Sts., to cost $350,000.

NEW YORK, N. Y.—Milliken Bros., 39 Cortlandt St., have been awarded the contract for the entire iron work for the Siegel, Cooper & Co.'s new building at Sixth Ave., extending from 18th to 19th Sts., and occupying about one-half the entire block. DeLemos & Cordes are the architects. The building will be 460 ft. long by 184 ft. wide, 6 stories and basement, and a tower in the front central portion extending up 11 stories. The building will be entirely fireproof and of skeleton construction. The columns will be of cast iron and arranged to receive two additional stories at some future date. About 8,000 tons of iron will be required in the construction of this work. The iron contract is one of the largest ever let in the city for a single structure.

ROCHESTER, N. Y.—The following bids were received by the committee June 11 for work on the new court house: Interior—Nell Bros. & Kern, Rochester, $340,863; Thomas W. Finucane, $361,000; J. P. Weston, $342,700; James C. Barry, $342,571; The Lautz Co., Buffalo, $348,000; A. Friedrichs & Son, $339,447; H. H. Edgerton, $391,200; W. H. Gorsline, $396,995. Elevator—Otis Bros., New York, $11,550; Graves Elevator Co., Rochester, $8,859; Morse Elevator Co., Philadelphia, $9,943; Standard Elevator & Mfg. Co., Chicago, $10,300.

PHILADELPHIA, PA.—Bids are asked until June 25 for putting in iron railings, painting and making alterations in nine school buildings. H. W. Halliwell, Secy. Bd. Pub. Education.

WASHINGTON, D. C.—Bids are asked until June 29 for miscellaneous cast and wrought iron work, and for plumbing materials, for the congressional library building. Bernard R. Green, Supt. and Engr.

WINFIELD, W. VA.—Bids are asked until July 1 for constructing a new court house on the public square. Arch., F. P. Milburn, of Kenova, W. Va.; R. A. Salmons, County Clk.

CHARLOTTE, N. C.—The county of Mecklenburg will build a new brick and stone court house at Charlotte. For plans and specifications, address Chairman Board of County Commissioners, Charlotte, N. C.

DUBLIN, GA.—Bids are asked until Aug. 6 for the erection and completion of a court house. Archs., Bruce & Morgan, Atlanta, Ga. J. F. Fuller, Chn. Comrs.

MADISON, GA.—Bids are asked until July 3 for the construction of two school buildings. Archs., Tinsley & Wilson, Lynchburg, Va.; W. F. Martin, Secy. Bd.

COLUMBUS, O.—Bids are asked until July 1 for erecting a brick church at Buttles and Harrison Aves. for the St. Francis' congregation. Address A. M. Leyden, Pastor, 386 Buttles Ave.

DETROIT, MICH.—Maj. M. B. Adams, U. S. Engr. Office, has recommended for acceptance for erecting an iron tower at Calumet Pierhead, Ill., the bid of the Russel Wheel & Foundry Co., of Detroit, at $3,735 for the tower and $4,185 for tower and patterns. John P. McGuire, of Cleveland, bid $3,870 for the tower and $4,155 for the tower and patterns.

TOULON, ILL.—It is reported that the board of supervisors at its meeting July 8 will vote on the question of building a new jail. W. W. Fuller, County Clk.

GRAND FORKS, N. DAK.—J. W. Ross has been engaged to prepare plans for a jail at Harvey, N. Dak. J. A. Williams, County Audr.

SALT LAKE CITY, UTAH.—The committee on prisons has been authorized to secure plans for a new jail, estimated to cost $25,000.

CHENEY, WASH.—Bids are asked until July 8 for erecting a normal school building on grounds owned by the state. Arch., C. B. Seaton, Spokane; W. J. Sutton, Clk. Bd. Trustees.

OLYMPIA, WASH.—Bids are asked until Aug. 20 for erecting a new state capitol building. Arch., Earnest Flagg, 54 Broad St., New York; J. H. McGraw, L. R. Grimes, Joseph S. Allen, State Capitol Com.

GALT, ONT.—Bids are asked until June 25 for the erection of a block of stores and offices. Arch., W. L. Munro, Hamilton, Ont.; address, David Spiers, Galt.

WATER-WORKS.

SOMERSWORTH, N. H.—The council is taking steps to secure new works, as recommended by the committee. David Wingate, Chn. Com.

NEWPORT, VT.—It is reported that H. S. Haskell, of this place, will construct a reservoir this summer near the present one.

ATHOL, MASS.—The water company is making several extensions and is reported as planning to lay over a mile of additional pipe.

WALPOLE, MASS.—F. C. Coffin, of Boston, has been engaged to prepare plans and specifications for works estimated to cost about $100,000.

WEST GARDNER, MASS.—A special town meeting has been called to consider the report of the water committee, of which J. H. Fairbank and B. D. Whitney are members.

AFTON, N. Y.—Bids are asked until July 2 for constructing works, including the furnishing and laying of 36,000 ft. of 8 to 4-in. pipe. P. A. Heys, Secy. Comrs.

AMSTERDAM, N. Y.—The commissioners are reported as about to build a dam 16 ft. high at the Cook reservoir.

ANTWERP, N. Y.—Plans for works have been prepared by Frank A. Hines, of Watertown. The village recently appropriated $25,000 for the construction. G. W. Hall, Secy.

BROOKLYN, N. Y.—Bids are asked until June 26 for 35,740 ft. of 48-in. cast iron pipe, 5,880 ft. of 36-in., 6,000 ft. of 30-in., and 720 ft. of 20-in., and 334,000 lbs. of special castings, as stated in our advertising columns. Alfred T. White, Comr. Cy. Wks.

COHOES, N. Y.—The water board has contracted with the Holly Mfg. Co. for a new pumping engine to cost $6,135.

DELHI, N. Y.—The Delhi Water Co. has agreed to make extensions and improvements estimated to cost about $10,000. John C. Stoddard, Village Clk.

DUNDEE, N. Y.—Plans for works are being prepared by Walter F. Randall. It is stated that an election will soon be held to vote on the question of construction.

FLUSHING, N. Y.—An election will be held June 25 to vote on the erection of a stand-pipe estimated to cost $35,000.

JEFFERSONVILLE, N. Y.—It is reported that works will be put in by a private company. Secy., John Glassel; Pres., Frank Lober.

LE ROY, N. Y.—It is expected that steps will soon be taken to put in works, which have been proposed for some time. S. D. Gilbert, Clk.

MADISON, N. Y.—C. S. Lewis, Clk., writes us that there is no prospect of works being put in this season. The committee is undecided in regard to a feasible water supply.

MIDDLEVILLE, N. Y.—It is stated that an election will be held at an early date to vote on the construction of works to cost $20,000.

MONTGOMERY, N. Y.—Bids are asked until July 1 for the purchase of $23,000 in 4% water bonds. Chauncy Brooks, Pres. Comrs.——Contracts for constructing works, as advertised in Engineering News, have been awarded as follows: Anniston Pipe & Foundry Co., for cast iron pipe; Eddy Valve Co., valves and hydrants; Henry R. Worthington, pumping machinery; Neff & Mitchell, of Newark, N. J., pipelaying; Struthers & Wells, R. H. Bethel, New York agent, stand-pipe, boilers and pumping station.

NEW YORK, N. Y.—Bids are asked until July 10 for the construction of the Jerome Park reservoir, near Kingsbridge, as stated in our advertising columns. Jas. C. Duane, Pres. Aqueduct Comrs.

OLEAN, N. Y.—The village of North Olean will hold a special election June 22 to vote on an appropriation of $15,000 for works, the supply to be from the city mains.

PAINTED POST, N. Y.—The proposition to issue $20,000 in bonds for works has been defeated. It is reported that only 67 of the 1,000 residents of the village are taxpayers and that 44 of these voted against the proposition.

PERRY, N. Y.—An election will be held June 27 to vote on the construction of works. It is stated that if this proposition is defeated a franchise will probably be granted. Thos. H. Bussey, Pres. Comrs.

RED HOOK, N. Y.—Bids are asked until July 9 for the construction of works, including about eight miles of pipe, reservoir, pumps, stand-pipe, etc. D. W. Wilbur, Pres. Comrs.

ROCKVILLE CENTER, N. Y.—Bids are asked until July 6 for the construction of works, as stated in our advertising columns. Engr., Winfield Davison; E. D. Seabury, Secy. Comrs.

SCHENECTADY, N. Y.—We are informed that the contract for the construction of the intake and infiltration galleries was let June 18 to John Twomey, of Schenectady, the lowest bidder. The contract for the pipe laying was awarded to J. Birdseye, of New York, the lowest bidder upon that work. The contract for the foundation for the water tower has been awarded to John Twomey. The work will be commenced at once, as the land has been obtained for the pump house, etc.

SYRACUSE, N. Y.—Bids are asked until July 1 for 50,000 lbs. of 1½ to ½-in. A.A.A. lead pipe, as stated in our advertising columns. W. R. Hill, Ch. Engr. Water Bd.

WHITESBORO, N. Y.—F. K. Baxter, of Utica, has been engaged to make a preliminary survey for proposed works in this village. It is thought that a supply can be secured from springs about one mile distant and 190 ft. above the village.

WARSAW, N. Y.—The commissioners have engaged Voorhees & Witmer, of Buffalo, as engineers of the proposed works.

YONKERS, N. Y.—Bids are asked until July 3 for laying about 2,500 ft. of water pipe. J. A. Lockwood, Clk. Comrs.

ASBURY, PARK, N. J.—Bids are asked until June 28 for pumping engines, and for water tube boilers and stack, as stated in our advertising columns. Geo. W. Treat, and John L. Coffin, commissioners.

ASBURY PARK, N. J.—The "Journal" states that S. L. Bartholomew has been awarded the contract for building works at Darlington, which will include five wells, eight hydrants and about 800 ft. of 8 and 4-in. pipe.

HACKETTSTOWN, N. J.—The "Republican" states that Edward Howell, of Morristown, is making surveys for a new reservoir on the Mine Hill Brook, estimated to cost $12,000.

TRENTON, N. J.—The following contracts were awarded June 12 for remodeling the pumping station: William Mills, carpenter work, $5,065; John Barlow, mason work, $6,686; New Jersey Steel & Iron Co., iron work, $4,103.

ALLEGHENY, PA.—It is reported that the following bids were received for the construction of the pump and engine houses for the new works: Beute & Martin, superstructure, $92,188; James Wherry, entire, $342,000; superstructure, $106,255; J. S. Patterson, substructure, $257,400; Patty & Gibson, complete, $312,000; substructure, $229,000. Sloan, McIlvain & Ott Bros., substructure, $235,000; John Schriner, substructure, $249,331; complete, $346,696. George A. Coughran, complete, $359,280; William Kerr's Sons, complete, $365,500; substructure, $259,095; above foundation, $106,405. Corcoran, Connell & Co., complete, $319,500; Fred Gwinner, Jr., complete, $375,000; substructure, $282,000. Joseph Glanini, substructure, $273,810; Harrold & McDonald, complete, $353,372; substructure, $235,608. Rose & Fisher, complete, $335,000; substructure, $235,000. McDonald Bros., substructure, $194,-

889; Morris & Bros., complete, $329,000; substructure, $220,190. Jutte, Foley & Co., complete, $292,000; substructure, $198,000. Dirver & Remson, complete, $410,-937; substructure, $318,200. L. H. Coughran, superstructure, $98,346. The committee has awarded contracts for water pipe branches and sleeves to the Crescent Foundry & Machine Co., and that for the pump and engine houses, complete, to Jutte, Foley & Co.

BRADDOCK, PA.—It is reported that a reservoir will be constructed as soon as possible.

BUTLER, PA.—A suit has been brought by the citizens to have the charter of the Butler Water Co. annulled.

EPHRATA, PA.—A special election will be held July 2 to vote on an issue of $30,000 in bonds for works.

HAZELTON, PA.—C. F. King is reported to have been awarded a contract for constructing a reservoir for the Lehigh Valley Water Co., near Oneida Junction.

KNOXVILLE, PA.—The borough council has granted a franchise to the St. Clair Water Co., the borough contracting for 20 hydrants at $20 a year each. Geo. I. Stahl, Clk.

MONACA, PA.—Bids are asked until June 27 for constructing works, including a 750,000-gallon pump, a 500,000-gallon reservoir, and 8 to 4-in. mains. J. P. Leaf, Engr.; S. D. Hamilton, Secy. Comrs.

NEW HOLLAND, PA.—H. K. Storb, Secy. New Holland Water Co., writes us that the construction of works is well under way. Edgar B. Kay, of Bellwood, Pa., has the contract for the complete construction. Engr., W. H. Allen, of Downington, Pa.

NICHOLSON, PA.—F. P. Stephens, Secy. Council, writes us that nothing will be done this season in regard to water-works.

JEFFERSON, MD.—The residents of this place are reported as agitating the question of constructing a reservoir for additional fire protection.

SHENANDOAH, VA.—C. Howell Noland, Secy. Milnes Water Co., writes us that the contract for works has been awarded to James M. Berry, of Bedford City, Va., at $17,000, and that the construction will be commenced in about a week.

MONROE, N. C.—We are informed that the question of works is being agitated. A subscription of $1,000 is being raised for the purpose of locating an artesian well, but this plan does not seem to be popular and the town commissioners will probably take the matter under consideration.

STATESBORO, GA.—A franchise is reported to have been awarded to W. D. Davis, who will construct works at once, the supply to be from artesian wells.

BIRMINGHAM, ALA.—It is reported that there is talk of organizing a company to supply the city with water from artesian wells, and that M. Sloss is interested.

CANTON, MISS.—B. Maas, Chn. Com., writes us that the city contemplates constructing works. Bids for constructing works and also for a franchise were received last February. H. W. Latimer, Cy. Clk.

JACKSON, TENN.—It is reported that a new pumping engine will soon be purchased. S. C. Lancaster, Cy. Engr.

LOGAN, O.—B. K. Tritsch, Secy., writes us that Frank Snyder, of Columbus, is preparing plans for works estimated to cost $35,000; proposed supply from wells; population, 3,500.

LORAIN, O.—G. W. Rafter, Consult. Engr., has recommended that the intake be extended two miles further into the lake, at an estimated cost of $58,000; other improvements proposed are estimated to cost $100,000. It is stated that a special election will soon be held to vote on an issue of bonds for this work.

TOLEDO, O.—A contract for laying 4,000 ft. of 6-in. pipe has been awarded to Perry Waite.

WAUSEON, O.—C. J. Nachtrieb, Corp. Clk., writes us that no steps have yet been taken toward constructing works.

COLUMBUS, IND.—Levi Hege, Cy. Engr., has submitted four plans for providing the city with a better water supply, the estimated cost being from $7,380 to $27,884.

GARRETT, IND.—The city clerk writes us that an engineer will probably be engaged this week to prepare plans and specifications for works, and that the contract will be awarded as soon as possible.

RICHMOND, IND.—It is reported that the park commissioners will construct a complete system of water-works at Glen Miller.

RUSHVILLE, IND.—Sanders & Porter, of Louisville, Ky., have been engaged to make surveys and plans for works, which will probably cost about $65,000. The city will either build or grant a franchise.

LEWISTON, MICH.—It is reported that this village has voted to issue bonds for works.

MILFORD, MICH.—An election will be held June 25 to vote on an issue of bonds for works estimated to cost $18,000. Geo. P. McCoy, Village Clk.

MAYWOOD, ILL.—Bids are asked until June 28 for a stand-pipe and foundations, as stated in our advertising columns. Engrs., Hill & Enright, Chicago; Samuel H. Danaldson, Jr., Village Clk.

ODELL, ILL.—J. H. Cosgrove, Clk., writes us that nothing has yet been done in regard to proposed works.

ELKHORN, WIS.—Bids are asked until July 1 for the construction of works, as stated in our advertising columns. Engr., W. S. Shields, Chicago; Jay F. Lyon, Village Clk.

OCONOMOWOC, WIS.—The city clerk writes us Fairbanks, Morse & Co. are making surveys for works and that probably an election will soon be held to vote on the question of construction.

TREMPEALEAU, WIS.—E. J. Hankey writes us that nothing has yet been done except to consider an estimate furnished by an engineer on the ground, but that the question will probably be submitted to a vote of the taxpayers at some future date.

MEMPHIS, MO.—Bids are asked until July 1 for constructing works, as described in our advertising columns. C. F. Sanders, Mayor.

BEDFORD, IA.—F. L. Sturtevant, Cy. Clk., writes us that the election to vote on the question of works has been postponed; population, 2,500.

BOONE, IA.—The city has sold $14,500 of 5% water bonds to N. W. Harris & Co., Chicago, for $14,780.

FAIRFIELD, IA.—T. F. Higly writes us that O. F. Harding, of Grinnell, has been awarded the contract for sinking a well. A deep well pump is yet to be purchased. The plant will be a small one.

KEOSAUQUA IA.—Jas. P. Starr, Cy. Clk., writes us that the question of works is being discussed, but that no action has yet been taken toward submitting the question to a vote of the citizens.

LOGAN, IA.—T. M. Adams, Cy. Recdr., writes us that the city intends to make extensions to cost about $5,000. The work will include a cyprus tank, a pump, a 15-HP. engine, about 4,500 ft. of 4-in. pipe, and 12 hydrants.

OELWEIN, IA.—The town has voted to issue bonds for works, according to reports.

ROCKWELL CITY, IA.—It is expected that contracts will be awarded within a few weeks for the construction of works, for which bonds were recently voted. Geo. W. Spencer, Cy. Clk.

KASSON, MINN.—This village has voted to issue $6,000 in bonds for works, which will be constructed as soon as possible.

NEW PRAGUE, MINN.—John Joach, Cy. Clk., writes us that J. F. McCarthy, of Minneapolis, is sinking wells, and that bids for constructing works will soon be asked. The plant will include a 60-ft. steel tower with a 20×24-ft. tank, a 7-HP. gasoline engine, and about 2,000 ft. of 10 to 4-in. pipe. Fairbanks, Morse & Co., of St. Paul, prepared the plans.

PINE ISLAND, MINN.—M. E. Billings, Recdr., writes us that Fairbanks, Morse & Co. have prepared plans for works, but that an election to vote on an issue of $5,000 in bonds for the construction has not yet been held.

SANDSTONE, MINN.—The Minnesota Sandstone Co. has awarded the contract for constructing works at this place, for which $10,000 was appropriated, as noted in our issue of May 30, to Fairbanks, Morse & Co.——The Sandstone Supply Co. has been incorporated with a capital stock of $25,000, to supply water, light and power at this place. Geo. W. Bestor, Pres. Minnesota Sandstone Co., and Clarkson Lindley, Secy., both of Minneapolis, are members of the new company.

ST. CHARLES, MINN.—N. D. Gould, Cy. Recdr., writes us that the contract for constructing works has been awarded to Thos. J. Green, of Winona, at $14,467 for the entire plant, except the arteslan well, and that this contract was awarded to Mr. Green at $2 a foot.

SPRINGFIELD, NEB.—James Pike, Cy. Clk., writes us that the proposition to issue water bonds failed to carry.

MITCHELL, S. DAK.—A. C. Pollard, Pres. Council, writtes us that about 1,500 ft. of 4-in. main will be laid this summer to secure better fire protection.

ARGENTINE, KAN.—The Argentine Water & Electric Light Co. is reported to have awarded Mayor Willard and F. J. Payne a contract for a well 55 ft. deep and 30 ft. in diameter, to cost $4,000. This well will be dug to secure a better water supply than is now obtained from the river.

GOLIAD, TEX.—Bids are asked until June 25 for constructing works. Address the Goliad Water & Light Co.

HILLSBORO, TEX.—Geo. R. Terrell, Cy. Secy., writes us that the city has decided to buy the necessary materials direct from the manufacturers and to construct works; estimated cost, $20,000; supply from artesian well; population 6,000. Engr., D. A. Poyner, Dallas, Tex.; Chn. Com., T. G. Hawkins.

HOUSTON, TEX.—The Houston Water-Works Co. is reported about to bore additional wells and to construct a large reservoir.

ONTARIO, CAL.—The Ontario Water Co. is reported to have sold $15,000 in bonds, the proceeds to be used in developing the Bodenhamer wells.

HARTLAND, N. B.—It is reported that bonds will be issued for works.

PERTH, ONT.—Bids are asked until July 20 for the construction of works on the franchise plan. John A. Kerr, Town Clk.

TORONTO, ONT.—Bids are asked until June 29 for the following water meters of the Siemens & Adamson pattern: 5 ¾-in., 10 1-in., 10 2-in., 15 3-in., 15 4-in., 16 5-in., 2 6-in., 2 8-in., 1 10-in. Daniel Lamb, Chn. Com.

IRRIGATION.

TOPEKA, KAN.—Press reports state as follows: The state irrigation commission has awarded the contract for the construction of the Haskell county irrigation plant to the United States Water Supply Co., of Kansas City. The contract for the Rooks county plant was awarded to Crane & Co., of Kansas City. An Illinois concern will construct the Trego county plant. The contract for the Rawlins county plant has not been let.

O'NEILL, NEB.—Press reports state that Messrs. Widner, Pres. First National Bank, and R. H. Wilfley, attorney, both of Corning, Ia., have purchased a controlling interest in the Elkhorn Irrigation Co. of this place. The company has a 13-mile canal completed and in running condition. The Elkhorn Irrigation Co. was organized about a year ago by Clarence Selah and others.

LINCOLN, NEB.—Local papers state that the Yellowstone Park Land & Irrigation Association, with headquarters in Lincoln, Neb., has been granted an application at Cheyenne for 14,000 acres of arid land along the Stioking Water River in Wyoming. The land is located 100 miles northwest of Sheridan and not far from the Billings extension of the Burlington & Missouri River Ry. The company has turned the water upon the land, through the irrigation ditches which are built from the river. The filing of this company is the first under the Carey act, which provides for the reclaiming of 1,000,000 acres of arid land in each of eight of the western states.

SEWERAGE.

BRUNSWICK, ME.—Bids are asked until June 27 for the construction of about 2½ miles of 12 to 6-in. pipe sewers; also separate bids for furnishing sewer materials, as stated in our advertising columns. Ch. Engr., Ernest W. Bowditch, 60 Devonshire St., Boston.

HILLSBORO BRIDGE, N. H.—A. W. Forbes has prepared plans for a system.

BOSTON, MASS.—Bids are asked by the metropolitan sewerage commissioners until July 6 for building the overflow at Belle Isle inlet, Winthrop and East Boston.

FALL RIVER, MASS.—The council has voted to construct a sewer in Flint St.

MELROSE, MASS.—Bids are asked until June 24 for purchasing $50,000 of 4% sewer bonds. George Newhall, Town Treas.

MILTON, MASS.—A town meeting will be held June 29 to consider the question of constructing a system.

NATICK, MASS.—Bids are asked by the town treasurer until June 24 for the purchase of $75,000 of 4% sewer bonds.

PITTSFIELD, MASS.—Surveys have been made for extending the sewers in nine streets.

CUMBERLAND, R. I.—W. H. Foley, Anthony I. Earle and John M. Ryan have been appointed a committee to secure estimates of the cost of a system, to include Ashton, Beakeley, Lonsdale and Valley Falls.

NEW LONDON, CONN.—It is reported that the committee will soon consider plans for a system in the southern part of the city, the outlet to be into the harbor.

DOLGEVILLE, N. Y.—Bids are asked until July 1 for the construction of 1,800 ft. of 12-in. sewer, as stated in our advertising columns. Wm. H. Collins, Engr.-in-Charge.

ITHACA, N. Y.—Bids are asked until June 29 for constructing 5,430 ft. of 8 and 6-in. pipe sewers, with 10 manholes. Henry N. Ogden, Ch. Engr.; R. B. Williams, Chn. Comrs.

MOUNT VERNON, N. Y.—It is proposed to construct lateral sewers in four streets.

SYRACUSE, N. Y.—The council has voted to construct 60 to 30-in. brick and 18 to 12-in. pipe sewers in several streets, at an estimated cost of about $40,000. H. F. Stephens, Cy. Clk.

BAYONNE, N. J.—It is proposed to construct sewers in two streets. W. C. Hamilton, Cy. Clk.

EAST ORANGE, N. J.—Bids are asked until July 8 for constructing sewers, as described in our advertising columns. Stephen M. Long, Township Clk.

IRVINGTON, N. J.—The construction of a system is being considered, according to reports.

NEWARK, N. J.—Rudolph Herlog, of New York, has been engaged to give advice as to the reconstruction of sewers in certain streets.

NEWARK, N. J.—Bids are asked until June 27 for constructing about 15,620 ft. of 22 to 6-in. pipe and about 5,000 ft. of 66 to 30-in. brick sewers. J. C. Mundy, Gen. Supt. Wks.——Ernest Adam, Cy. Surv., has recommended the construction of a new flume for the intercepting sewer. This flume is about two miles long, and was built in 1884 at a cost of $150,000. It was repaired in 1889 at a cost of $5,298, but a large part is now destroyed.

SOMERVILLE, N. J.—It is proposed to construct a trunk sewer about 7,000 ft. in length along Peter's Brook, and branches to connect with it, for the accommodation of that portion of the town so situated as to be unable to use the system already built. The work will be in charge of Joshua Doughty, Jr., Engr., with H. M. Herbert, of Bound Brook, as consulting engineer.

TRENTON, N. J.—It is proposed to construct sewers in a number of streets. C. E. Murray, Clk. Council.

DARBY, PA.—Bids are asked until July 1 for constructing sewers in two streets. Henry Hewes, Chn. Highway Com.

HOMESTEAD, PA.—An election will be held July 23 to vote on the question of issuing $10,000 in bonds for sewers, $25,000 for street improvements, etc.

NEW CASTLE, PA.—Bids are asked until June 24 for constructing sewers in three streets. Frank Tidball, Cy. Clk.

PHILADELPHIA, PA.—The committee on surveys has authorized the construction of main sewers in 13 streets, at an estimated cost of $213,000. Jacob Seeds, Chn.

TURTLE CREEK, PA.—An election will be held July 23 to vote on the question of issuing bonds for constructing sewers and paving the streets.

BALTIMORE, MD.—The council proposes to appropriate $140,000 for a sewer in Alluvian St. and $24,000 for a sewer in Brice Alley.

CLEVELAND, O.—Plans have been prepared for sewers in 10 streets. S. G. McClure, Secy. Bd. Control.

MISHAWAKA, IND.—The construction of a system is being considered.

STERLING, ILL.—J. F. Barrett, Cy. Clk., writes us that the contract for constructing the West Broadway system has been awarded to Geo. S. Miller & Co., of Ottawa, Ill., the bids being as follows:

M. C. Sloan & Co., Chicago, Ill.	$16,394
Wm. E. Dee, 116 Quincy St., Chicago	15,535
Campbell, Dennis & Co., Ottawa, Ill.	12,529
Geo. S. Miller & Co., Ottawa, Ill.	10,313
Rockford Construction Co., Rockford, Ill.	13,752
F. L. Reeves, 155 Milwaukee St., Elgin, Ill.	14,956
A. Maloney, 3533 Ward Ave., Chicago	12,979
Farrell & Green, 59 Dearborn St., Chicago	12,278
Hanlon & Knepper, Sioux City, Ia.	11,934
H. D. Hallett, Aurora, Ill.	12,993
J. P. Shanahan, 846 Warren Ave., Chicago	14,168
William F. Cooney, Perwyn, Ill.	13,187
F. H. Cooper, Terre Haute, Ind.	13,960
John Herley & Co., Des Moines, Ia.	13,400
Madlem & Fink, Goshen, Ind.	13,246
Blake, Steuck & Farrell, Dubuque, Ia.	15,954
Thomas Tole, Rockford, Ill.	13,911

KANKAKEE, ILL.—W. S. Shields, Consult. Engr., Title & Trust Bldg., Chicago, has been engaged to design a system. W. K. Woodruff, Cy. Engr.

WINNETKA, ILL.—Bids are asked until July 1 for constructing 15 to 8-in. pipe sewers, as stated in our advertising columns. C. W. Tostevin, Village Clk.

ROCHESTER, MINN.—It is reported that Fred Youngren, of Minneapolis, was the lowest bidder for constructing a main sewer in Broadway at $4,059. The estimated cost was about $7,000.

IOWA CITY, IA.—Bids are asked until June 25 for constructing about 2,600 ft. of 48 to 36×24-in. brick sewers, average cut 9 ft. Chas. S. Magowan, Cy. Engr.

HIAWATHA, KAN.—The council has directed that an engineer be engaged to superintend the construction of a number of sewers.

MARYSVILLE, CAL.—F. E. Smith, Cy. Clk., writes us that an election to determine whether or not $40,000 worth of bonds shall be issued for a system of sewers for drainage purposes, and for filling certain low lands in the city, was to be held June 18. If the proposition is carried, work will probably be begun and completed at once. If not carried, the work will probably be begun anyway and completed in three or four years.

GARBAGE DISPOSAL.

ALBANY, N. Y.—The special committee, consisting of Mayor Wilson, Dr. F. E. Curtis and Health Commissioner P. E. McCabe, has reported in favor of a Holthaus garbage digestor, made at Canarsie, N. Y. The report estimates that it would cost the city about $3,400 a year to destroy 25 to 40 tons a day by this utilization process.

CHICAGO, ILL.—Local papers state that John Cudahy, C. H. Aldrich, Victor Weise, ex-Judge A. A. Goodrich, who is president, and others, have organized the American Refuse Crematory Co., and have constructed an experimental crematory at the corner of Lincoln and 43d Sts. The furnace is 30 ft. long, 12 ft. wide and 20 ft. high, and it is expected that 2,500 tons of garbage can be consumed in a day.

STREETS AND ROADS.

BOSTON, MASS.—Bids are asked by the water board, until June 25 for building roads at Basin 5 of the waterworks. The work will consist of 211,000 cu. yds. of earth excavation, 1,310 cu. yds. of split stone masonry (laid dry), 217 cu. yds. of paving laid in mortar, 365 cu. yds. of American cement concrete, 145 cu. yds. of dry rubble masonry, 6,589 cu. yds. of riprap, and 1,989 lin. ft. of stone wall.

NEW BEDFORD, MASS.—The board of public works has voted to macadamize and pave eight streets. W. S. Cook, Asst. Cy. Clk.

BRIDGEPORT, CONN.—The council is considering the question of paving a portion of Broad St. with asphalt, at an estimated cost of $10,000.

BROOKLYN, N. Y.—Bids are asked until June 25 for repaving portions of four streets with asphalt; and until June 27 for paving Dwight St. with cobblestones. A. T. White, Comr. Cy. Wks.

BUFFALO, N. Y.—Bids are asked until June 26 for paving portions of seven streets. R. G. Parsons, Secy. Dept. Pub. Wks.——Bids are asked until July 2 for paving Front Ave. with asphalt. Wm. McMillan, Park Comr.

GREAT NECK, N. Y.—Twombly & Eldert, of Jamaica, have been awarded the contract for macadamizing about 13,100 lin. ft. of the Little Neck road, in North Hempstead, at $12,445.

EAST NORWICH, N. Y.—Press reports state as follows: The Queens county board of supervisors has passed a resolution for the building of the macadamized road from Roslyn to East Norwich. This is an extension of the Northside macadamized road through Flushing and North Hempstead, and will give a continuous macadamized road through the country; 1½ miles will have to be built in North Hempstead; over five miles in Oyster Bay town. The board estimate that, owing to the reduced price of stone, the extension can be built at a cost of $10,000 a mile.

NEW YORK, N. Y.—Press reports state that Governor Morton has appointed on the commission to inquire into the expediency of constructing a sewer and a highway along the valley of the Bronx River in Westchester and New York counties, Charles H. Wilson, of Mount Vernon; James Wood, of Bedford; W. Delavan Baldwin, of Yonkers; Fordham Morris and Archibald S. Van Orden, of New York city. The mayors of New York, Yonkers and Mount Vernon, the Street Commissioner of the Twenty-third and Twenty-fourth Wards in New York city, and the Chairman of the Westchester county Board of Supervisors, are ex-officio members of the Commission.

STAPLETON, N. Y.—Bids are asked until July 8 for regulating, grading and constructing macadam roads in Richmond county, Staten Island, as described in our advertising columns. The recent resolution appropriating $340,000 for new roads has been rescinded, and $440,000 has been appropriated. The supervisors will sell $100,000 in bonds on July 24. Henry P. Morrison, Engr.; Hanklin C. Vitt, Clk.

TROY, N. Y.—The contracting board received the following bids June 12 for paving Pawling Ave. with different kinds of brick:

Mack fire clay:	
John P. Kelly	$53,368
Casey & Cavanaugh	58,965
P. McKenna	61,510
M. Murray	62,808
Rogers Construction Co.	60,233
P. H. Feeley	60,047
Mack shale:	
Casey & Cavanaugh	58,760
Rogers Construction Co.	60,233
Metropolitan:	
John P. Kelly (awarded contract)	53,858
Rogers Construction Co.	56,133
Halloway:	
Casey & Cavanaugh	57,735
P. Callanan	58,514
Catskill:	
J. H. Cavanaugh	53,870

WAVERLY, N. Y.—The trustees are considering the question of purchasing a stone crusher and macadamizing the roads.

BRIDGETON, N. J.—The council has voted to pave Laurel St. with Belgian blocks, at an estimated cost of $3,000.

IRVINGTON, N. J.—Bids are asked until July 1 for constructing flagstone sidewalks. C. H. Terrill, Village Clk.

PATERSON, N. J.—Bids are asked until July 1 for resurfacing 7½ miles of roads and for furnishing 1,330 cu. yds. of broken stone and screenings. Richard E. Doremus, Chn. Com.; A. B. Pearce, Clk. Bd. Freeholders.

TRENTON, N.J.—Bids are asked until July 2 for improving portions of two streets. C. E. Murray, Cy. Clk. ——The council is considering the question of paving West State St. with brick.

DARBY, PA.—Bids are asked until July 1 for grading two streets. Henry Hewes, Chn. Com.

HOMESTEAD, PA.—An election is to be held July 23 to vote on the question of issuing $25,000 in bonds for street improvements, $10,000 for sewers, etc.

PHILADELPHIA, PA.—Bids are asked until June 25 for paving portions of a number of streets and alleys. T. B. Stulb, Health Officer.

READING, PA.—Press reports state that in pursuance of a resolution of the councils authorizing the mayor to appoint an advisory committee for the purpose of suggesting to the councils a plan for street paving, the mayor has named the following as members of the committee: George F. Baer, Henry Epplimer, William H. Kelly, Jonathan G. Leinbach and James H. Carpenter.

SHERIDANVILLE, PA.—The taxpayers of Sheriden have defeated the proposition to issue $70,000 in bonds for paving the streets.

TURTLE CREEK, PA.—The council has decided to hold an election July 23 to vote on the question of issuing $50,000 in bonds for public improvements.

INDIANAPOLIS, IND.—Contracts for the following improvements will be let about July 18 if there is not sufficient remonstrance to stop the work. North Meridian St. resolutions for wooden block were stopped by legal remonstrances, and the board has adopted two sets of resolutions differing somewhat from the former ones. One set calls for asphalt 50 ft. wide for 575 ft., rectangular red cedar 50 ft. wide for 1,900 ft. and the same 36 ft. wide for 3,734 ft.; the other set calls for asphalt throughout of the above widths. It is not known which set will be successful. Resolutions have been adopted for cedar block pavement in Central Ave. 4,217 ft. by 36 ft.; also for macadam pavement with granite wearing surface in Capitol Ave. in two sections, 3,474 ft. by 59 ft. and 2,373 ft. by 40 ft.—— Plans have been ordered for about 6,000 ft. of cement sidewalks.

ADRIAN, MICH.—Bids are asked until June 21 for curbing and paving Church St. with brick. James Blaine, Cy. Engr.; John Maudsley, Cy. Clk.

JACKSON, MICH.—The council has ordered the construction of a number of cement sidewalks, and has voted to pave portions of two streets with brick.

WAUKEGAN, ILL.—Bids are asked until July 15 for grading, laying 1,110 lin. ft. of curbing, and 2,800 sq. yds. of brick paving in Genesee St., and 3,930 lin. ft. of curbing and 10,365 sq. yds. of brick paving in Madison, County and Washington streets, as stated in our advertising columns. Robt. B. Conolly, Cy. Clk.

APPLETON, WIS.—The council is considering the question of advertising for bids for paving five streets, the contracts for which will probably be awarded about Aug. 1.

DUBUQUE, IA.—An ordinance is before the council authorizing the paving of Locust St. with brick or asphalt.

ST. LOUIS, MO.—Bids are asked by the board of public improvements until June 28 for paving five streets with brick and one street with asphalt.——It is proposed to improve portions of six streets.

RIVERSIDE, CAL.—It is reported that at an election held June 6 it was voted to issue $90,000 in bonds for paving and improvements.

MONTREAL, QUE.—Bids are asked until July 3 for furnishing paving blocks and brick and for paving a portion of Notre Dame St. P. W. St. George, Cy. Surv.

MANUFACTURING PLANTS.

NEW CASTLE, PA.—A press report states that the directors of the proposed new tube works, at a meeting held June 14, decided to locate the plant on the old fair grounds, just outside the city limits. The site is convenient to the six or seven railways running through the city.

CHARLOTTE, N. C.—R. A Blythe, of this city, is interested, with a number of Philadelphia capitalists, in a new cotton mill, which will be built and equipped at this place, at an estimated cost of $150,000. An electric light plant will form part of the equipment. ——The Highland Park Mfg. Co. will put in spinning machinery at the gingham mills at an early date.

CONCORD, N. C.—J. L. Crowell and associates will build and equip a $100,000 cotton mill, to be operated by water power, at Yadkin Falls, N. C. V. Mauney and J. M. Badgett, of Jackson Hill, N. C., are interested.

RALEIGH, N. C.—T. L. Eberhardt & Co., proprietors of the Raleigh Ice & Refrigerating Co.'s artificial ice manufactory will at once build a duplicate plant of 12,000 tons daily capacity.

EDGEFIELD, S. C.—Ex-Senator Mathew C. Butler and ex-Governor J. C. Sheppard and others will build a $100,000 cotton mill at this place and equip the same with 10,000 spindles and 300 looms. The equipment will include an electric light plant.

AUGUSTA, GA.—The Langley Mfg. Co. is reported about to add 15,000 spindles to its plant. The company now operates 20,000 spindles.——The Enterprise Mfg. Co. is reported to have voted to increase its capital stock $500,000 to increase the capacity of its cotton mills.

AKRON, O.—O. C. Barber, Pres. Diamond Match Co.; Monroe Selberling, of the Diamond Plate Glass Co., of Kokomo, Ind.; Captain A. P. Baldwin, of the Akron Iron Co., and other prominent manufacturers are said to be interested in a tin plate plant, the erection of which is about to be commenced in this city. There will be six mills and 600 men will be employed, according to the report. Captain Baldwin will be superintendent.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

STREET SWEEPER.—Marinette, Wis.—Bids are asked until June 24 for a street sweeper. E. L. Shaw, Cy. Engr.

PILE WORK.—Sioux City, Ia.—Bids are asked until July 6 for driving piles. Capt. H. F. Hodges, U. S. Engr. Office.

STREET CLEANING.—Camden, N. J.—Bids are asked until June 21 for cleaning paved streets, collecting ashes and garbage, etc. Chas. P. Sayrs, Chn. Com.

PARK WORK.—Albany, N. Y.—A bill was signed by the governor a short time ago allowing this city to appropriate $80,000 for improving Beaver Park. The work will begin in a few days.

BREAKWATER.—Manitowoc, Wis.—It is reported probable that a new breakwater will be built at this place this summer. It will be about 400 ft. long and will cost about $40,000.

DREDGING.—Brooklyn, N. Y.—Bids are asked until June 28 for dredging at the navy yard. This is reported as a large contract. Address E. O. Matthews, Ch. of Bureau Yards and Docks, Washington, D. C.

FIREBOX BOILERS.—Boston, Mass.—Bids are asked until June 22 for furnishing and delivering three firebox boilers for fog signals, as stated in our advertising columns. Maj. W. R. Livermore, U. S. Lighthouse Engr.

RIPRAP STONE.—Tompkinsville, N. Y.—Bids are asked until June 22 for furnishing and placing riprap stone at light stations in the third district, as stated in our advertising columns. 1st Lieut. Wm. E. Craighill, U. S. Lighthouse Engr.

DREDGING AND REMOVING LEDGE.—Newport, R. I.—Bids are asked until July 17 for dredging on Noyes Shoal, near Stonington, Conn., and for removing ledge rock in Newport Harbor. First Lieut. Wm. W. Harts, U. S. Engrs.

CANAL IMPROVEMENT.—Albany, N. Y.—A correspondent writes us that a party left Albany June 17 for Long Island to make surveys for improvements on the Shinnecock Canal. This work is being done under the direction of the state engineer.

SMOKE PREVENTING DEVICE.—Cleveland, O.—Bids are asked by the board of control until July 8 for equipping six tubular boilers, 8 ft. in diameter and 16 ft. long, and six marine boilers, 10 ft. in diameter and 17 ft. long, with smoke preventing devices.

STEAM HEATING AND POWER PLANT.—Waupaca, Wis.—Bids are asked until July 1 for furnishing all materials and constructing a central steam heating and power plant at the Wisconsin Veterans' Home. J. H. Woodnorth, Secy., 135 Grand Ave., Milwaukee.

TELEPHONE LINE.—Raleigh, N. C.—We are informed that Chas. E. Johnson, of Raleigh, N. C., who has leased the cotton compresses at Raleigh and Hamlet, N. C., will establish a telephone line between the two places, along the Raleigh & Augusta R. R., a distance of nearly 100 miles, with connections with intermediate towns and villages.

STEAM ROAD ROLLER.—Wilmington, Del.—Local papers state that the following bids have been received for a seven or eight-ton steam roller: Harrisburg Machine Co., $3,100; Erie Machine Co., $2,000; W. C. Osler, $2,900; Springfield Steam Road Roller Co., $2,800. The street department is reported as to buy a roller, but wishes to examine them first.

WHARF AND JETTY WORK.—Tompkinsville, N. Y. —Bids are asked until June 21 for rebuilding landing wharf at Plum Island light station, N. Y.; for repairing the wharf of the lighthouse depot at New London, Conn.; and for constructing jetty at Faulkner Island light station, Conn.; and until June 22 for building two stone jetties at Point Comfort light station, N. J., and for rebuilding landing wharf at Little Gull Island light station, N. Y. 1st Lieut. Wm. B. Craighill, U. S. Lighthouse Engr.

CONTRACT PRICES.

MACADAMIZING AND SEWERS.—Argentine, Kan.—Geo. M. Walker, Jr., Cy. Engr., writes us that at the last meeting of the city council the following bids were opened, and the contract awarded to the lowest bidders: For macadamizing Silver Ave., including excavation for sub grade, considerable of the material being rock—R. B. Brown, $1.45; T. J. Enright, $1.429; engineer's estimate, $1.57.

Sewer in Sub-District No. 2, in Sewer District No. 2.

	Trumpet arch conn.	39-in. brick.	30-in. pipe.	Manholes.	Catchbasins.	Oak lumb'r M.ft.
R. B. Brown	$50.00	$4.08	$3.40	$33.00	$36.00	$20.00
C. E. Dodson	....	4.35	4.15	47.00	50.00	25.00
T. J. Enright	51.00	4.050	3.300	30.00	30.00	20.00
Engineer's estimate	175.00	4.10	3.42	40.00	40.00	25.00

ASPHALT PAVING.—Brooklyn, N. Y.—N. P. Lewis, Engr. of Local Improvements, writes us that the following bids were received June 6 for paving with asphalt on concrete foundation:

		T. D. Bradford	Cranford & Co.	E. J. McKeever & Bro.	Eastern Bermudez Asp. Paving Co
Schermerhorn St., from Smith St. to Nevins St.:					
Paving	7,063 sq. yds.	$2.09	$1.93	$2.63	$2.75
Line impr't	2,064 lin. ft..	.30	.80	.28	.50
Redress'g curb,	1,970 " "	.20	.20	.20	.20
New curb	1,970 " "	.60	.60	.60	.65
Reflagging	1,000 sq. ft..	.03	.03	.05	.05
Total		$16,986	$17,072	$20,779	$22,178
Clinton St., from Fulton St. to Pierpont St.:					
Paving	1,479 sq. yds.	$2.09	$1.93	$2.75	$2.75
Line impr't	544 lin. ft..	.30	1.30	.28	.43
Redress'g curb,	955 " "	.20	.20	.20	.20
New curb	107 " "	.60	.60	.60	.65
Reflagging	200 sq. ft..	.03	.03	.05	.05
Total		$3,516	$3,823	$4,485	$4,572
Dean St., from Fourth Ave. to Flatbush Ave.:					
Paving	3,394 sq. yds.	$2.09	$1.93	$1.96	$2.75
Line impr't	930 lin. ft..	.30	.30	.28	...
Redress'g curb,	1,056 " "	.20	.20	.25	.20
New curb	724 " "	.60	.60	.30	.65
Reflagging	200 sq. ft..	.03	.03	.05	.05
Total		$8,024	$7,481	$7,404	$10,025
Flatbush Ave., e. s. Willink entrance to Prospect Park:					
Paving	1,590 sq. yds.	$2.09	$1.93	$2.45	$2.75
Line impr't	600 lin. ft..	.30	.30	.28	...
Redress'g curb,	322 " "	.20	.20	.20	.20
New curb	322 " "	.60	.60	.60	.65
Reflagging	100 sq. ft..	.03	.03	.05	.05
Total		$3,791	$3,536	$4,351	$4,651
For asphalt laid on cobblestone pavements:					
Paving	679 sq. yds.	....	$1.23	$1.80	$2.00
Line impr't	150 lin. ft..	...	...	.28	...
Repg cblstn pg	410 sq. yds.	...	.30	.28	.30
Total		....	$958	$1,379	$1,481

SEWERS.—Indianapolis, Ind.—A contract was awarded June 13 for sewer in Alley north of Dougherty

St., with branches 3,323 ft. long, consisting of 1,522 ft. of 18-in. pipe, 713 ft. of 15-in., 568 ft. of 12-in., 380 ft. of 100-in., 140 ft. of 8-in., 1,007 ft. of 6-in. house connections, 8 catchbasins, 12 manholes, 2 lampholes, 2 flush tanks, to Fulmer-Seibert Co., at $1.07 a lin. ft., other bids ranging from $1.09 to $1.73.

SEWERS.—Medford, Mass.—The awarding of contracts for the construction of portions of sections 1, 2, 5 and 6 of the sewerage system was noted last week under Sewerage. T. Howard Barnes, Cy. Engr., informs us that the itemized bids for section 5 were as follows:

Bids Received June 5 for Constructing Section 5, Medford, Mass., Sewerage System.

Quantities.		R. Falvey, Somerville.	Lindsey & Cudmore, Somerville.	A. W. Byrne, W. Medford.	Gennaro, Long & Little, So. Braintree.	F. A. Snow, Boston.	F. L. Allen, Worcester.	D. F. McCarthy, Lawrence.	Weaving, Booth & Parry, Medford.	D. O'Connell, Dorchester.	Little & Effler, Boston.
Earth excav., 0 to 8 ft.	18,000 cu. yds.	$0.40	$0.60	$0.54	$0.50	$0.70	$0.60	$0.60	$0.80	$0.71	$0.75
" " 8 " 14 " ..	2,000 " "	.70	1.00	.80	.75	.80	1.00	.90	.90	1.30	1.75
" " 14 " 20 " ..	300 " "	1.00	1.50	1.00	1.50	1.50	1.50	1.00	1.00	2.00	3.50
Rock " 0 " 8 " ..	50 " "	2.00	5.00	.10	4.00	1.50	4.50	4.00	3.00	3.00	4.00
" " 8 " 14 " ..	50 " "	2.50	6.00	.10	7.00	2.00	6.00	5.00	3.00	5.00	7.00
" " 14 " 20 " ..	20 " "	2.50	6.00	.10	8.00	2.00	7.00	5.00	3.00	5.00	9.00
Brick	180 " "	5.00	4.50	6.00	4.50	5.00	5.00	6.00	5.00	5.25	6.00
Concrete	200 " "	3.00	4.00	4.00	4.00	5.00	4.50	5.00	4.50	4.00	3.50
Rubble	20 " "	3.00	3.00	.10	5.00	6.00	3.00	4.00	3.00	5.00	5.00
Pipe, 6 to 12-in.	22,000 lin. ft..	.10	.05	.10	.15	.05	.10	.12	.09	.15	.10
" chimneys	200 vert. ft.	.04	.05	.10	.10	.10	.05	.10	.05	.10	.10
Subdrain laid	16,000 lin. ft..	.24	.15	.15	.25	.20	.25	.30	.20	.25	.40
Spruce lumber,	4 M. ft...	25.00	40.00	40.00	35.00	40.00	35.00	30.00	20.00	35.00	25.00
Total		$16,883	$19,200	$18,294	$20,830	$21,365	$22,125	$23,190	$23,990	$25,785	$29,380

STREET LIGHTING.—Washington, D. C.—The contract for furnishing, operating and maintaining 1,000 naphtha lamps in the District of Columbia, has been awarded to the Pennsylvania Globe Gas Light Co., of Philadelphia, Pa., at $20.25 per lamp per year. Bids were received for gas lighting, but were rejected, and no bids were received for electric lighting.

GRADING, ETC.—Albany, N. Y.—The contract for grading and macadamizing the Northern Boulevard, for which bids were opened June 17, has been awarded to Peter Calanan, the bids being as follows:

		Peter Calanan.	M. J. Dady.	P. H. Reilly.
Excavation	20,400 cu. yds.	$0.20	$0.23	$0.15
Filling	20,900 " "	.05	.05	.12
Brkn stone surfg.	16,600 sq. "	.70	.70	1.25
*20-in. vit. pipe..	800 lin. ft..	.83	1.35	1.25
15-in. vit. pipe..	160 " "	.34	1.25	.80
10-in. " " ..	100 " "	.22	.65	.60
**2½-in. tile drain	800 " "	.06	.25	.22
Cobble gutters	12,500 " "	.20	.20	.27
Elm trees	180.....	1.50	7.00	1.50
Total		$22,103	$26,266	$32,677

* Extra heavy. ** With collar.

ASPHALT PAVING.—St. Paul, Minn.—The contract for paving West Third St. from Seven Corners to Pleasant Ave. has been awarded by the board of public works to the Warren-Scharf Asphalt Paving Co. at $5,232, or $2.70 per sq. yd. Hennessey & Cox bid $5,497. Local papers state that the price for this work is not as low as the bid on Fourth St., but is considered quite reasonable, considering the smallness of the contract. The contract does not include the space between the tracks of the street railway, which is now paved with granite.

BRICK PAVING.—Ithaca, N. Y.—Henry A. St. John, Supt. Pavement Com., writes us that the contract for brick paving, as advertised in Engineering News, has been awarded to James McCloud, of Williamsport, Pa., at 21 cts. per cu. yd. for excavation, $1.68 per sq. yd. for paving with West Virginia repressed brick on 6 ins. concrete foundation, and 50 cts. per lin. ft. for 20-in. Medina curbing.

BRICK PAVING.—Latrobe, Pa.—L. W. Fogg, Borough Engr., writes us that the contract for brick paving, for which bids were opened June 10, has been awarded to John Herman, at the following prices: Grading, 32 cts. per cu. yd.; curbing, 50 cts. per lin. ft.; paving, $1.18 per sq. yd. for pitch filling, or $1.11 for sand; catchbasins, $25 each; sewer pipe, 82 cts. per ft.; cast iron gutter crossings, $42 per ton; relaying pavement at crossings, 30 cts. per sq. yd. The curbing is to be of durable sandstone 30 ins. in length, 24 or 36 ins. deep and 6 ins. thick, and the paving of vitrified fire brick upon 6 ins. of broken stone, 2 ins. of gravel and 2 ins. of sand, the brick to be laid on edges with lengths in straight curves transversely to the line of the street. The total bids were as follows:

	Brick. Mack.	Brick. Park.
John Herman	$9,625	$9,625
McConoughy & Bennett	9,983	9,631
Sawders & Houston	10,248	....
J. P. McIntyre	10,633	....
G. W. Good	11,695	....
G. Anderson & Sons	....	10,403

PUMPING ENGINES.—Brooklyn, N. Y.—I. M. de Varona, Engr. of Water Supply, has sent us the following comparative table of the bids received May 21 for pumping engines, as advertised in Engineering News: Steam pressure, 125 lbs.; duty, 125,000,000 ft.-lbs. per 1,000 lbs. steam; annual cost per million gallons daily capacity, coal at $3.75 per ton, evaporation 10 lbs., $633.07; for sinking fund (renewal) charges economical life of engine is assumed as 30 years, and that of building as 50 years, interest compounded at 3%.

SUMMARY AND COMPARATIVE TABLE OF BIDS RECEIVED MAY 21, 1895, FOR SECTION 1 (ENGINES, FOUNDATIONS, ETC.), AT THE RIDGEWOOD PUMPING STATION, BROOKLYN, N. Y., WATER-WORKS.

Bidder.	No. of engines.	Capacity, mill. galls.	Assumed lift, ft.	Location, eng. house.	Floor space occupied, ft.	Height above bed plate, ft.	Weight of each engine, lbs. (1 = 1,000.)	Diameter of crank shaft, ins.	Steam cylinders, diam. ins. No.	H. p.	Int.	L. p.	Water cylinders. No.	Diam.	Stroke, ins.	Piston speed, ft. per minute.	Price.	Annual expenses and charges. Coal at $3.75 per ton. Evap. 10 lbs.	Interest on cost of plant at 4%	Sinking fund.	Totals. Without sinking fund.	With sinking fund.	Annual cost per mill. galls. daily capacity. Int. on cost of plant at 4%.	Sinking fund.	Totals. Without sinking fund.	With sinking fund.
Edward P. Allis Co.	3[2]	20	170	Old eng. h.	18.0x31.0	40.5	1,200	16 to 18	3	31	56	82	3	34	64	200	$250,500	$41,584	$10,020	$5,266	$51,604	$56,869	$167	$88	$860	$948
" " " "	4[2]	20	170	Old eng. h.	18.0x31.0	49.5	1,200	16 to 18	3	31	56	82	3	34	64	200	334,500	55,448	13,380	7,031	68,828	75,859	167	88	860	948
Geo. F. Blake Mfg. Co.	4[2]	20	170	Old.[2]	20.5x51.0	29.5	1,180	19¾	3	32	54	84	3	34½	60	200	415,940[3]	55,448	16,638	8,561	72,085	80,646	208	107	901	1,008
" " " "	4[2]	20	170	Old eng. h.	16.0x51.0	29.5	1,180	19¾	3	32	54	84	3	34½	60	200	406,940	55,448	16,638	8,428	71,485	79,913	200	105	894	999
Groshon H.-D. P'mp'g Eng. Co.	3[2]	20	170	Old.[2]	18.0x36.5	30.0	1,400	18	3	30	54	80	3	34½x24½	60	200	242,530[3]	41,584	9,701	4,910	51,285	56,194	162	82	835	937
" " " "	4[2]	20	170	Old.[2]	18.0x36.5	30.0	1,400	18	3	30	54	80	3	34½x24½	60	200	310,530[3]	55,448	12,421	6,339	67,869	74,207	155	79	848	928
Holly Mfg. Co.	3[2]	20	170	Old.[2]	18.0x34.0	28.0	1,100	17¾	3	30	52	76½	3	34½	60	200	188,000[3]	7,520	3,803	49,104	52,907	57,427	125	63	818	882
" " " "	4[2]	20	170	Old.[2]	18.0x34.0	28.0	1,100	17¾	3	30	52	76½	3	34½	60	200	245,130[3]	55,448	9,805	5,004	65,253	70,257	123	63	816	878
A. J. L. Loretz	3[2]	20	170	Old eng. h.	15.0x44.0	26.0	1,200	18½	3	30	54	56	2	42	48	200	260,750	41,584	10,430	5,841	52,014	57,495	174	91	867	958
" " " "	4[2]	20	170	Old eng. h.	15.0x44.0	26.0	1,200	18½	3	30	54	56	2	42	48	200	347,650	55,448	13,906	7,308	69,354	76,661	174	91	867	958
" " " "	3[2]	20	170	Old eng. h.	15.0x36.0	30.0	900	18	3	30	50	80	3	34	60	200	201,250	41,584	8,050	4,230	49,634	53,864	134	71	827	898
" " " "	4[2]	20	170	Old eng. h.	15.0x36.0	30.0	900	18	3	30	50	80	3	34	60	200	268,350	55,448	10,734	5,641	66,182	71,822	134	71	827	898
Henry R. Worthington	3[2]	20	170	Old.[2]	17.0x27.0	42.0	800	....	6	23	36	66	2	33½	61½	160	186,000	41,584	7,440	3,910	49,024	52,933	124	65	817	882
" " " "	4[2]	20	170	Old.[2]	17.0x27.0	42.0	800	....	6	23	36	66	2	33½	61½	160	248,000	55,448	9,920	5,213	65,368	70,580	124	65	817	882
" " " "	3[2]	20	170	Old.[2]	17.0x27.0	42.0	800	....	6	23	36	66	2	33½	61½	160	186,000	41,584	7,440	3,910	49,024	52,933	124	65	817	882
" " " "	4[2]	20	170	Old.[2]	17.0x27.0	42.0	800	....	6	23	36	66	2	33½	61½	160	248,000	55,448	9,920	5,213	65,368	70,580	124	65	817	882
* Edward P. Allis Co.[1]	2[2]	30	170	Old eng. h.	14.0x36.0	54.7	1,600	18 to 20	3	39	70	104	3	42	72	196	224,400	41,584	8,976	4,717	50,560	55,277	150	79	843	921
" " " "	3[2]	30	170	Old eng. h.	14.0x36.0	54.7	1,600	18 to 20	3	39	70	104	3	42	72	196	333,000	62,378	13,320	7,089	75,698	82,697	148	78	841	919
" " " "	2[2]	30	170	New eng.h.	14.0x36.0	54.7	1,600	18 to 20	3	39	70	104	3	42	72	196	307,000[3]	41,584	12,280	5,250	53,864	59,114	205	88	898	985
" " " "	3[2]	30	170	New eng.h.	14.0x36.0	54.7	1,600	18 to 20	3	39	70	104	3	42	72	196	411,000[3]	62,378	16,440	7,436	78,818	86,254	183	83	876	958
* Geo. F. Blake Mfg. Co.	3[2]	20	170	Old eng. h.	20.5x51.0	29.5	1,144	19¾	3	32	54	84	3	34½	60	200	300,705	41,584	12,028	6,321	53,612	59,933	200	105	894	999
* Holly Mfg. Co.	2[2]	30	170	Old eng. h.	19.0x36.5	31.0	1,380	19	3	36	62½	92	3	42½	60	200	176,800	41,584	7,072	3,716	48,656	52,372	118	62	811	873
" " " "	3[2]	30	170	Old eng. h.	19.0x36.5	31.0	1,380	19	3	36	62½	92	3	42½	60	200	203,300	62,378	10,532	5,535	72,910	78,444	117	61	810	872
" " " "	2[2]	30	170	Old eng. h.	19.0x36.5	31.0	1,380	19	3	36	62½	92	3	42½	60	200	176,800	41,584	7,072	3,716	48,656	52,372	118	62	811	873
" " " "	3[2]	30	170	Old eng. h.	19.0x36.5	31.0	1,380	19	3	36	62½	92	3	42½	60	200	203,300	62,378	10,532	5,535	72,910	78,444	117	61	810	872
* A. J. L. Loretz	3[2]	20	170	New eng.h.	15.0x44.0	26.0	1,200	18½	3	30	54	56	2	42	48	200	380,750[3]	41,584	15,230	6,545	56,814	63,359	254	109	947	1,056
" " " "	4[2]	20	170	New eng.h.	15.0x44.0	26.0	1,200	18½	3	30	54	56	2	42	48	200	467,650[3]	55,448	18,706	8,372	74,154	82,526	234	105	927	1,032
" " " "	3[2]	20	170	New eng.h.	15.0x44.0	26.0	1,200	18½	3	30	54	56	2	42	48	200	380,750[3]	41,584	15,230	6,545	56,814	63,359	254	109	947	1,056
" " " "	4[2]	20	170	New eng.h.	15.0x44.0	26.0	1,200	18½	3	30	54	56	2	42	48	200	467,650[3]	55,448	18,706	8,372	74,154	82,526	234	105	927	1,032
" " " "	3[2]	20	170	New eng.h.	15.0x36.0	30.0	900	18	3	30	50	80	3	34	60	200	320,750[3]	41,584	12,830	5,200	54,414	59,704	214	88	907	995
" " " "	4[2]	20	170	New eng.h.	15.0x36.0	30.0	900	18	3	30	50	80	3	34	60	200	387,850[3]	55,448	15,514	6,701	70,962	77,662	194	84	887	971
" " " "	3[2]	20	170	New eng.h.	15.0x36.0	30.0	900	18	3	30	50	80	3	34	60	200	320,750[3]	41,584	12,830	5,200	54,414	59,704	214	88	907	995
" " " "	4[2]	20	170	New eng.h.	15.0x36.0	30.0	900	18	3	30	50	80	3	34	60	200	387,850[3]	55,448	15,514	6,701	70,962	77,662	194	84	887	971
" " " "	3[2]	20	170	Old eng. h.	15.0x44.0	26.0	1,200	18½	3	30	54	56	2	42	48	200	260,750	41,584	10,430	5,481	52,014	57,495	174	91	867	958
" " " "	4[2]	20	170	Old eng. h.	15.0x44.0	26.0	1,200	18½	3	30	54	56	2	42	48	200	347,650	55,448	13,906	7,308	69,354	76,661	174	91	867	958
" " " "	3[2]	20	170	Old eng. h.	15.0x44.0	26.0	1,200	18½	3	30	54	56	2	42	48	200	260,750	41,584	10,430	5,481	52,014	57,495	174	91	867	958
" " " "	4[2]	20	170	Old eng. h.	15.0x44.0	26.0	1,200	18½	3	30	54	56	2	42	48	200	347,650	55,448	13,906	7,308	69,354	76,661	174	91	867	958
" " " "	3[2]	20	170	Old eng. h.	15.0x36.0	30.0	900	18	3	30	50	80	3	34	60	200	201,250	41,584	8,050	4,230	49,634	53,864	134	71	827	898
" " " "	4[2]	20	170	Old eng. h.	15.0x36.0	30.0	900	18	3	30	50	80	3	34	60	200	268,350	55,448	10,734	5,641	66,182	71,822	134	71	827	898
* Henry R. Worthington	3[2]	20	170	Old.[2]	17.0x27.0	42.0	800	....	6	23	36	66	2	33½	61½	160	186,000	41,584	7,440	3,910	49,024	52,933	124	65	817	882
" " " "	4[2]	20	170	Old.[2]	17.0x27.0	42.0	800	....	6	23	36	66	2	33½	61½	160	248,000	55,448	9,920	5,213	65,368	70,580	124	65	817	882
" " " "	3[2]	20	170	New eng.h.	17.0x27.0	42.0	800	....	6	23	36	66	2	33½	61½	160	265,000[3]	41,584	10,600	4,610	52,184	56,794	177	77	870	947
" " " "	4[2]	20	170	New eng.h.	17.0x27.0	42.0	800	....	6	23	36	66	2	33½	61½	160	327,000[3]	55,448	13,080	5,914	68,528	74,441	164	74	857	930
" " " "	2[2]	30	170	New eng.h.	15.0x30.0	42.0	1,200	....	6	29	46	82	2	41	61½	160	258,500[3]	41,584	9,540	4,052	51,124	55,175	159	68	852	920
" " " "	3[2]	30	170	New eng.h.	15.0x30.0	42.0	1,200	....	6	29	46	82	2	41	61½	160	318,500[3]	62,378	12,740	5,733	75,118	80,851	142	64	835	898
" " " "	2[2]	30	170	Old.[2]	15.0x30.0	42.0	1,200	....	6	29	46	82	2	41	61½	160	159,350	41,584	6,374	3,350	47,958	51,307	106	56	799	855
" " " "	3[2]	30	170	Old.[2]	15.0x30.0	42.0	1,200	....	6	29	46	82	2	41	61½	160	239,350	62,378	9,574	5,031	71,952	76,983	106	56	799	855
" " " "	3[2]	20	170	Old.[2]	17.0x27.0	42.0	800	....	6	23	36	66	2	33½	61½	160	186,000	41,584	7,440	3,910	49,024	52,933	124	65	817	882
" " " "	4[2]	20	170	Old.[2]	17.0x27.0	42.0	800	....	6	23	36	66	2	33½	61½	160	248,000	55,448	9,920	5,213	65,368	70,580	124	65	817	882

* Alternative proposals. [1] These bids provide for additional capacity of 11%, instead of 12½%, as in the "regular." [2] Old engine house or same extended. [3] Single acting, crank and flywheel. [4] Differential crank and flywheel. [5] Single acting, bucket-beam and flywheel. [6] Single acting, bucket-crank and flywheel. [7] Direct, double acting. [8] These bids include cost of enlargement of engine house or new building.

GRANITE PAVING.—Brooklyn, N. Y.—N. P. Lewis, Engr. Local Impvts., informs us that the following bids were received June 6 for paving with granite on 6 ins. concrete foundation:

Bidders.	Granite pavement, 15,000 sq. yds.	Granite bridging, 4,581 sq. ft.	Bluestone bridging, 970 sq. ft.	New curb, 3,704 lin. ft.	Curb redress'd, 926 lin. ft.	Concrete found'n, 2,800 cu. yds.	Re-flagging, 1,500 sq. ft.	Total.
Fulton St., from Willoughby to Sands Sts., (pitch and gravel joints).								
Thomas Monahan	$2.45	$0.95	$0.01	$0.50	$0.25	$0.65	$0.05	$44,765.15
Stratford & Hawkes	2.65	.60	.40	.65	.35	5.00	.05	57,193.30
Cody Bros.	2.99	.60	.40	.65	.20	3.75	.02	59,234.40
Michael J. Dady	2.83	.65	.50	.80	.17	4.50	.05	50,458.27
Daniel J. McCoy	3.00	.70	.20	.70	.20	.20	.05	60,810.70
E. J. McKeever & Bro.	3.24	.70	.01	.30	.25	3.95	.02	62,319.10
John McNamee	3.00	.65	.40	.75	.15	5.00	.04	62,842.55
Charles Hart	4.00	.65	.40	.65	.25	6.00	.05	79,879.75

Bidders.	Granite pavement, 13,883 sq yds.	Granite bridging, sq. ft.	Bluestone bridging, 100 sq. ft.	New curb, 3,500 lin. ft.	Curb redress'd, 1,000 lin. ft.	Concrete found'n, 2,233 cu. yds.	Re-flagging, 1,000 sq. ft.	Total.
Washington Ave., from Flushing to Kent Aves., (sand joints).								
Thomas Monahan	$2.15	$0.95	$0.02	$0.50	$0.25	$0.25	$0.01	$36,337.45
Cody Bros.	1.99	.56	.37	.60	.20	3.35	.02	39,774.72
Daniel J. McCoy	2.50	.60	.20	.65	.18	.15	.02	40,012.45
John G. Smith	2.73	.73	.50	.55	.20	.06	.05	43,270.82
E. J. McKeever & Bro.	2.29	.70	.01	.30	.25	3.49	.05	43,823.74
Stratford & Hawkes	2.15	.55	.40	.65	.25	4.50	.05	45,020.70
Mr. Newman	2.05	.69	.45	.65	.17	5.00	.04	45,141.40
Michael J. Dady	2.13	.65	.50	.80	.17	4.50	.05	45,370.54
Charles Hart	2.75	.60	.40	.65	.25	6.00	.05	56,696.25

ASPHALT PAVING.—Milwaukee, Wis.—Contracts have been awarded to the Western Paving & Supply Co. for considerable asphalt paving in Prospect Hill, at $1.95 per sq. yd. for the paving, 30 cts. for curbing, and $2.15 for repaving openings. The Warren-Scharf Asphalt Paving Co. bid $2.12 for the paving. The bids were considered very low. The lowest was 14 cts. lower than bids on similar work in the same neighborhood last year.

DREDGING.—Baltimore, Md.—The Baltimore Dredging Co. has been awarded a contract by the harbor board for dredging 125,000 cu. yds. of material, at 11¾ cts. a cu. yd. for harbor and channel work, 12½ cts. for dredging Spring Gardens, and 35 cts. for dredging Jones Falls, north of Canton Ave.

BRICK PAVING.—Troy, N. Y.—The following bids were received for paving Pawling Ave., with fire brick, according to local papers: Rogers Construction Co., Metropolitan shale block, $2.39 per sq. yd.; Mack block, $2.59; curbing, 75 cts. per lin. ft.; repairing catchbasins, $15; resetting old curb, 18 cts. John P. Kelly, $2.26 for Mack shale block; $2.48 for Mack patent fireclay block; new curb, 80 cts.; old curb reset, 10 cts. Patrick H. Feeley, $2.53 for Mack paving brick; new curb, 85 cts.; setting old curb, 15 cts.; setting bridge stone, 15 cts.; catchbasins, $25 each. Martin Murray, $2,65 for paving; new curb, 89 cts.; old curb, 20 cts.; catchbasins, $13; drains, $20. Casey & Cavanaugh, Holloway shale, $2.38; new curb, 94 cts. Peter Callahan, Vitrified paving brick, $2.44; new bridge stone, 80 cts.; laying curb, 88 cts.; resetting old curb, 25 cts.; catchbasins, $15; drains, $25. Jos. H. Cavanaugh, shale brick, $2.15; new curb, $1.04; repairing catchbasins, $10; building railway drains, $25. Patrick McKenna, $2.55 for paving; resetting old curb, 25 cts.

METAL MARKET PRICES.

LEAD.—New York: 3.3 to 3.35 cts. Chicago: 3.1 to 3.2 cts. St. Louis: 3.1 cts.

FOUNDRY AND PIG IRON.—New York: $10.50 to $12.50. Pittsburg: $10.50 to $11.25. Chicago: $10.25 to $11.50.

TRACK MATERIAL.—New York: Angle bars, 0.95 to 1.05 cts.; spikes, 1.4 to 1.45 cts.; track bolts, 1.85 to 2 cts. with square, and 2 to 2.1 cts. with hexagon nuts. Chicago: angle bars, 1.25 to 1.35 cts.; spikes, 1.8 to 1.85 cts.; track bolts, 2 cts., with hexagon nuts.

RAILS.—New York: $22.00 at eastern mills and $22.75 at tidewater; prices are now reported as being raised; old rails, $12 for iron, and $10 to $10.50 for steel; steel rails, fit for relaying, $14; light rails, $20 to $21; girder rails, $24. Pittsburg: $22 for standand sections of 45 lbs. and over; $23 for light sections; old rails, $12.50 for iron and $10 for steel. Chicago: $23 for standard sections; $25 for light sections; old rails, $13 to $14 for iron, and $8.50 to $12 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.3 to 1.5 cts.; channels, 1.35 to 1.5 cts.; angles, 1.2 to 1.35 cts.; tees, 1.4 to 1.6 cts.; universal mill plates, 1.3 to 1.35 cts.; steel plates, 1.2 to 1.3 cts. for tank, 1.35 to 1.45 cts. for shell, 1.5 to 1.65 cts. for flange, 1.75 to 2 cts. for ordinary firebox, 2 to 2.5 cts. for locomotive firebox. Pittsburg: beams 1.3 to 1.7 cts.; channels, 1.3 to 1.7 cts.; angles, 1.2 to 1.25 cts.; tees, 1.35 to 1.4 cts.; universal mill plates, 1.25 to 1.3 cts; steel plates, 1.3 to 1.4 cas. for tank, 1.4 to 1.45 cts. for shell, 1.45 to 1.5 cts. for flange, 2 cts. for ordinary firebox, and 2 to 4 cts. for locomotive firebox. Chicago: beams, 1.55 to 1.6 cts.; channels, 1.55 to 1.6 cts.; angles, 1.45 to 1.5 cts.; tees, 1.65 to 1.7 cts.; universal plates, 1.55 to 1.6 cts.; steel plates, 1.55 to 1.6 cts. for tank, 1.75 to 2 cts. for flange, 2.1 to 4.5 cts. for firebox.

STEEL RAILS.—The bulletin of the American Iron and Steel Association, issued June 18, states as follows: On June 10 we announced that an early increase in the price of steel rails from $22 to $24 was exceedingly probable. We can now state that sales were made last week at Pennsylvania mills at $24, and that other Pennsylvania mills decline to enter orders at any lower price. We feel sure that before this week ends all the steel rail mills in the country will advance their price to a basis of $26 at Pennsylvania mills. Since the first of June large sales of rails have been made in the East and West. For immediate delivery it would be very difficult to now place orders with any of the Eastern or Western rail mills. Prices of other iron and steel products are still advancing. The demand is entirely normal, and results from reduced stocks and increased confidence in the future.

INDUSTRIAL NOTES.

THE SOUTH BALTIMORE CAR CO., of Baltimore, Md., is building 50 cars for the Merchants' Coal Co.

THE ILLINOIS STEEL CO., of Chicago, Ill., is reported as intending to erect a new mill for structural iron work.

RITER & CONLEY, of Pittsburg, Pa., are reported as intending to remove to Allegheny, Pa., and to erect a new boiler shop, 150 × 300 ft.

THE LACONIA CAR CO., of Laconia N. H., is building 200 box cars, 200 flat cars and 200 coal cars, all of 60,000 lbs. capacity, for the Boston & Maine R. R.

THE PENNSYLVANIA STEEL CO., of Steelton, Pa., has a contract for a steel coal tipple 500 ft. long at Cumberland, Md., for the Baltimore & Ohio R. R.

THE ROGERS LOCOMOTIVE & MACHINE CO., of Paterson, N. J., is building for the Chilean Government Railways 2 eight-wheel and 2 ten-wheel engines, all two-cylinder compound engines.

MILLIKEN BROS., of New York, have been awarded a contract for a large department store in New York which will require 8,000 tons of iron in the construction. The contract is noted more fully under Buildings.

THE J. P. WITHEROW CO., of New Castle, Pa., has a contract for a steel water tank 16 ft. diameter and 50 ft. high, of 75,000 gallons capacity, for the New Castle Tin Plate Co. The tanks will be placed on a masonry tower.

THE INTERNATIONAL POST CO., of St. Louis, Mo., has completed a contract of 36 miles of fencing, using 8,000 of its steel fence posts, carrying twelve strands of barbed wire. The posts are said to have been set at the rate of 400 per day.

THE LEAD LINED IRON PIPE CO., of Wakefield, Mass., through J. F. Lovejoy, New York, Agt., has just closed a contract with the Larchmont, N. Y., Water Co. to lay its lead lined pipe from the mains to the meters in all the houses.

THE NEW CASTLE SEAMLESS STEEL TUBING CO., of New Castle, Pa., will establish a plant for manufacturing seamless tubing for bicycles, boiler tubes, poles for electric railways, etc. Man., John H. Preston; Secy., David C. Wallace.

THE SIEMENS & HALSKE ELECTRIC CO., of Chicago, Ill., is reported to have sold a controlling interest to a syndicate of capitalists represented by Charles T. Yerkes, of Chicago. The capital stock has been increased from $1,000,000 to $2,000,000.

THE RICE & SARGENT ENGINE CO., of Providence, R. I., has received an order for a vertical engine, 28 × 60 × 48, 1,800 HP., 100 revolutions, 150 lbs. steam, with pulley flywheels adapted for a rope drive, and also a standard engine 12 × 30, 75 HP., 110 revolutions, for the Whitman Mills, New Bedford, Mass.

THE EDWARD P. ALLIS CO., of Milwaukee, Wis., has a contract for seven duplex cross-compound blowing engines for the new blast furnaces of the Carnegie Steel Co., at Duquesne, Pa. The steam cylinders are 40 × 60 and 78 × 60 ins., and the blowing cylinders 76 × 60 ins.

THE F. D. CUMMER & SON CO., of Cleveland, O., reports the sale of one of its direct-heat brick dryers to the Royal Brick Co., Canton, O., and is well satisfied at securing this order, as it will place the brick dryer in one of the most modern and best equipped plants in the country.

THE WEIR FROG CO., of Cincinnati, O., has slightly changed the design of its new automatic spring switch stand from that shown in our issue of June 14, 1894, and reports a large trade for its first year on the market. It is said to have proved a success in always keeping the switch points close up to the main or stock rails.

THE GROSHON HIGH DUTY PUMPING ENGINE CO., of New York, N.Y., has been awarded the contract for a pumping engine of 20,000,000 gallons capacity at Cambridge, Mass., the bids for which were given in our issue of June 6. This is the third contract for large pumping engines awarded to this company within a few months.

HOLMES & COGAN, of Jersey City, N. J., have the contract for the masonry for twelve bridges on the Montauk extension of the Long Island R. R. from Bridgehampton to Fort Pond Bay. They are also building a spur from the Fifth Ave. line of the Brooklyn Elevated R. R. to connect with the Prospect Park & Coney Island R. R. at 36th St. and 5th Ave.

THE H. S. SANDS ELECTRIC & MFG. CO., of Wheeling, W. Va., has the contract for an electric light and power plant for the new tin-plate mill of the La Belle Iron Works. There will be a generator supplying current for 20 arc lights and 200 incandescent lights, and another supplying current for a traveling crane and motors for the mill, lathe, and shearing machines.

THE MICHIGAN PIPE CO., of Bay City, Mich., has made alterations in its plant for creosoting wooden pipe and wooden conduits for electric wires, and has put in a new treating cylinder and additional woodworking machinery. Large amounts of conduit have been supplied for Philadelphia, Brooklyn and other eastern cities.

THE PITTSBURG BRIDGE CO., of Pittsburg, Pa., has moved its Chicago office to the Marquette Building, at Dearborn and Adams Sts. During the past year it has increased its shop facilities by the construction of a large permanent machine for the manufacture of draw-span turntables, on which it can plane drum and tracks while assembled entire, insuring absolute accuracy of track surface, and the installation of additional drills, enabling it to handle reamed work much more conveniently than heretofore. In the work of the last year is included the large double-deck railway and highway bridge over the Mississippi River for the South St. Paul Belt R. R. The draw span is 442 ft. long and weighs 770 tons.

NEW COMPANIES.—United States Nut Lock Co., Pittsburg, Pa.; $100,000; Robert C. McChesney, Edwin W. Smith and J. M. Shields.

Ensign Ferry Co., Huntington, W. Va.; $10,000, with $4,300 paid in; Rufus Switzer and F. F. McCullough.

Morris Crusher & Pulverizer Co., Cleveland, O.; $100,000; E. M. Hepler, W. F. Walworth and John W. Morris.

T. & P. Co., Jersey City, N. J.; tools and water, gas and steam fittings; Wm. J. O'Brien, Patrick J. Sullivan and Thomas J. Muggins.

Sheedy Automatic Railway Signal Co., Portland, Me.; $200,000; Robert J. Sheedy, of Boston, Mass.; F. A. McIntyre and John Savage, of Portland, Me.

Sweeney Anti-Friction Journal Co., New York, N. Y.; $100,000; Henry Lange and J. G. Charles, of Brooklyn, N. Y.; P. S. Henderson, of New York, N. Y.

Standard Silica Cement Co., Queensbury, N. Y.; cement sidewalks; $100,000; W. W. Macklay, F. W. Waite and Joseph Fowler, of Glens Falls, N. Y.

Waring-Prindle Pump Co., North Plainfield, N. J.; $100,000, with $1,000 paid in; Edward J. Waring, North Plainfield, N. J., and Franklin C. Prindle, Brooklyn, N. Y.

Ansonia Refining Co., Jersey City, N. J.; $75,000, with $25,000 paid in; metal refining and smelting; Edgar Buffman, Newark, N. J.; Leonard Lemsohn, New York, N.Y., and Edward L. Smith, Monroe, Conn.

American Construction & Improvement Co., Camden, N. J.; $100,000, with $1,000 paid in; Schuyler C. Woodhull, of Camden, N. J.; Crosby M. Black and George Rodgman, of Chester, Pa.

Beacon Incandescent Gas Light Co., New York, N.Y.; $2,000,000, with $1,000 paid in; gas burners and mantles; F. C. Hollins and Henry T. Buell, of New York; F. P. Share, of Brooklyn, N. Y.

NOTICE TO MANUFACTURERS.

The Engineers' Club of Columbus, O., informs us that it will be pleased to receive all trade publications for the purpose of forming a catalogue library. Address all matter to 12½ North High St., Columbus, O.

CONTRACT WORK

of all kinds, and in any section of the United States or Canada, should be advertised in Engineering News, which is probably read by a greater number of prominent contractors each week than are any other five papers in this country.

RECEIVED TOO LATE.

We continue to receive proposal advertisements and news items on Thursday morning, for insertion in the issue of that week. The first pages of Engineering News go to press on Tuesday and the last pages on Wednesday afternoon of each week. All matter for publication should be received by Wednesday noon.

VALUABLE ITEMS.

Much of the very best information published in our Construction News comes to us from subscribers who send items in reference to work with which they are connected or in which they are interested. Such reliable items are not only greatly desired by us, but frequently result in much good to the sender, by bringing his name and his work to public attention. If you are not already doing so, we ask you, hereafter, to send us the earliest possible information of work that comes under your notice.

RAILWAY WORK

noted in this paper is usually awarded to reliable contractors at economical prices. Railway officials are invited to avail themselves of our columns to secure competition for new equipment or construction. We ask especially that early notice of all projected new work be sent us.

PROPOSALS FOR BRIDGE WORK

should be inserted in Engineering News, as this paper is read each week by nearly every bridge company and prominent bridge contractor in this country, and work advertised in these columns is thus given the utmost possible publicity.

RESULTS OF A TRIAL.

Sterling, Ill., June 17, 1895.

Engineering News Publishing Co.,

Tribune Building, New York City.

Gentlemen:

I enclose list of bids received June 13 for the West Broadway sewer. In this connection I beg leave to inform you that our city realized this time as never before the benefits of advertising its work in the Engineering News. We did not advertise for bids in any paper except the News, and had time for but one insertion in that, and yet I received 112 applications for specifications, and we received 17 bids, while twice that number of bidders were on the ground.

Yours truly,

J. F. Barrett, City Clerk.

MORE THAN 150 REPLIES were received, an engineer writes us, from a recent insertion of a water-works advertisement in Engineering News. It would have taken a large number of daily papers and cost a considerable sum of money to have secured this result by the old-fashioned method of advertising work only in daily papers.

YOU are interested in municipal economy and SHOULD use your influence to have your city ADVERTISE work where competition is secured and YOUR contracts can be awarded at low prices. WORK can now be done at a small cost IN this country, if those desiring bids for ENGINEERING supplies or construction will use our NEWS columns to call attention to their work AND will advertise for bids in this paper, and thus SAVE in the cost of advertising and also save MONEY by awarding contracts at low prices.